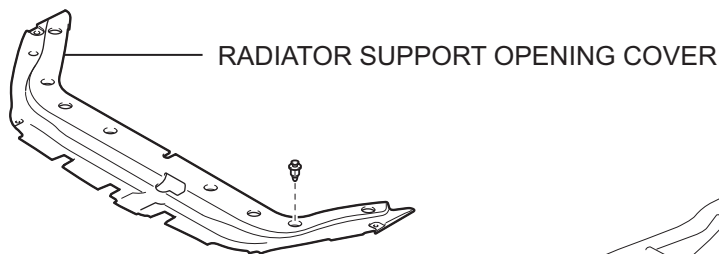


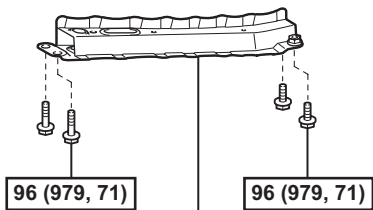
CYLINDER HEAD

COMPONENTS

EM



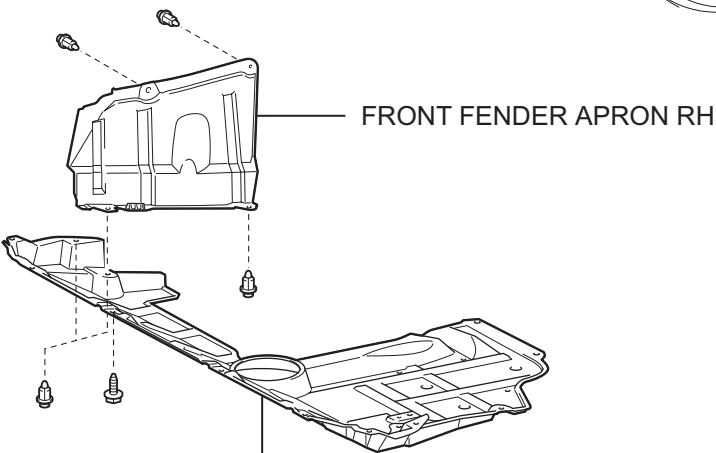
RADIATOR SUPPORT OPENING COVER



96 (979, 71)

96 (979, 71)

FRONT SUSPENSION MEMBER REINFORCEMENT RH



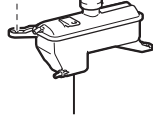
FRONT FENDER APRON RH

NO. 1 ENGINE UNDER COVER

N*m (kgf*cm, ft.*lbf) : Specified torque

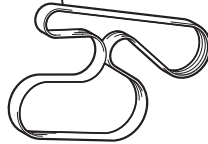
5.0 (51, 44 in.*lbf)

x 2



RADIATOR RESERVOIR

FAN AND GENERATOR V BELT



NO. 1 ENGINE COVER

7.0 (71, 62 in.*lbf)

x 2



60 (612, 44)

x 2



IDLER PULLEY

95 (969, 70)

x 4

ENGINE MOUNTING
INSULATOR RH

52 (530, 38)



8.4 (86, 74 in.*lbf)

HEATED OXYGEN SENSOR
CONNECTOR

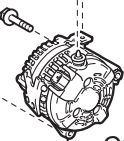
9.8 (100, 7)



● GASKET

52 (530, 38)

21 (215, 15)



COMPRESSION SPRING

GENERATOR ASSEMBLY

x 2

43 (438, 32)

● GASKET

43 (438, 32)

43 (438, 32)

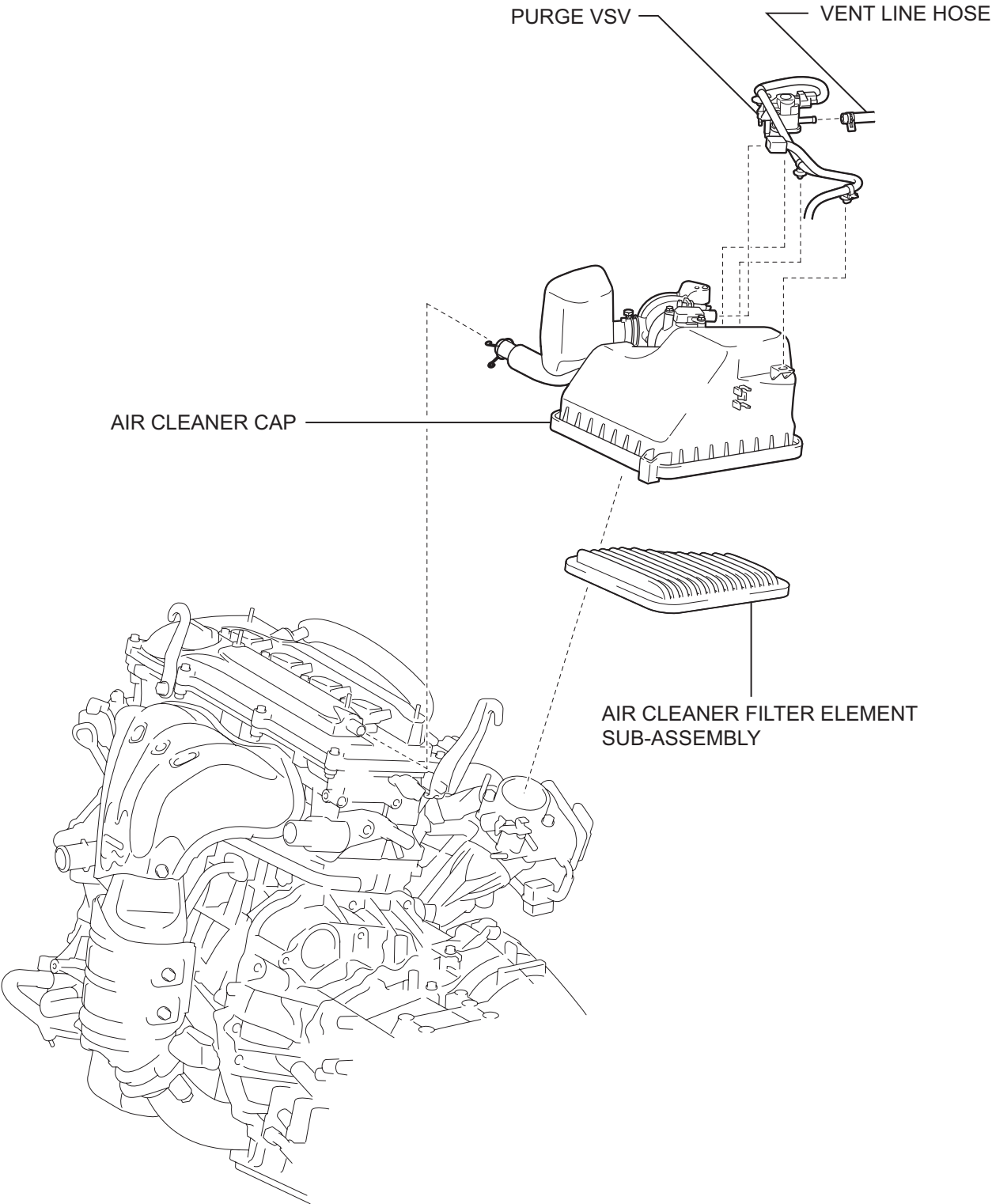
FRONT EXHAUST PIPE

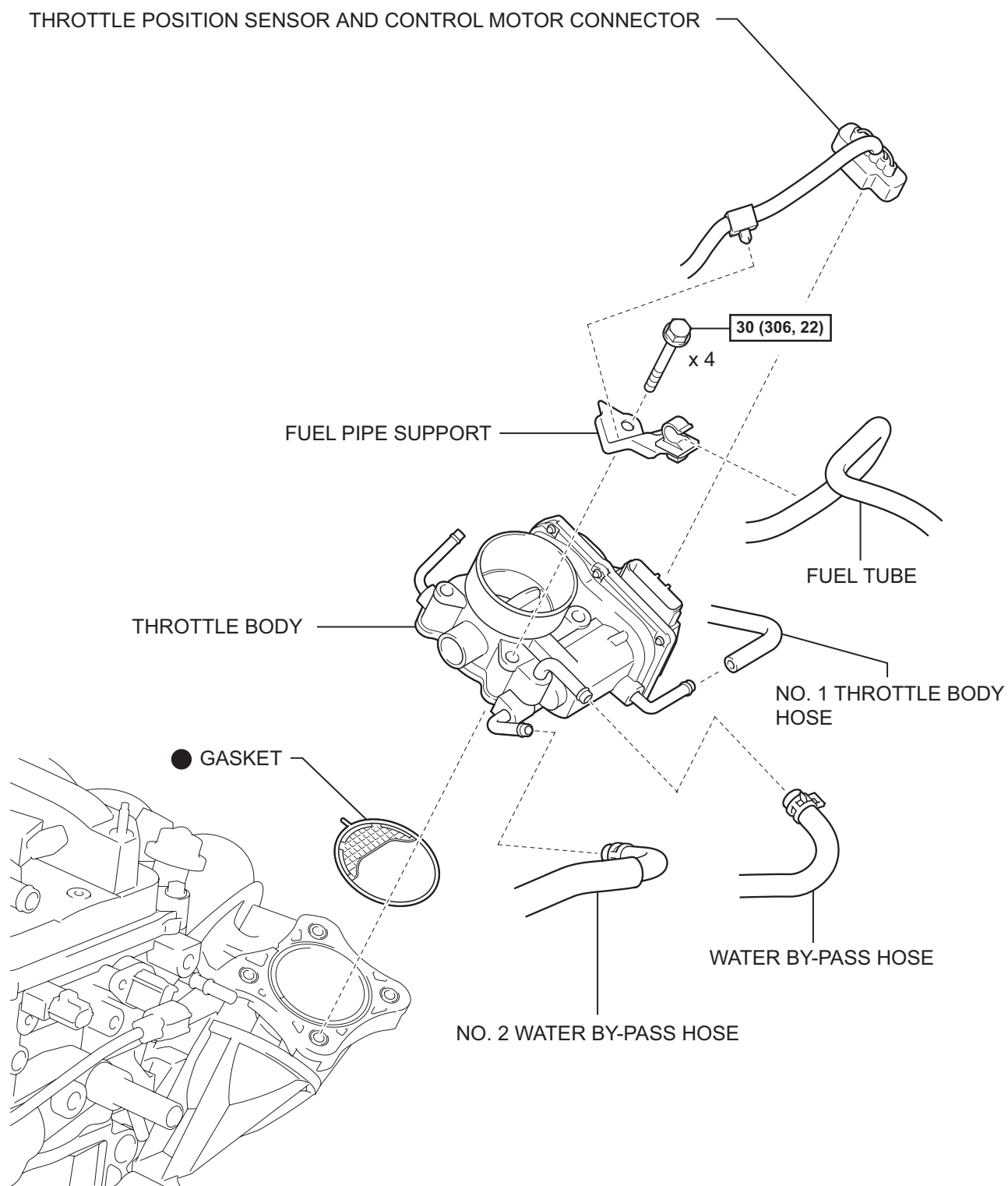
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

EM

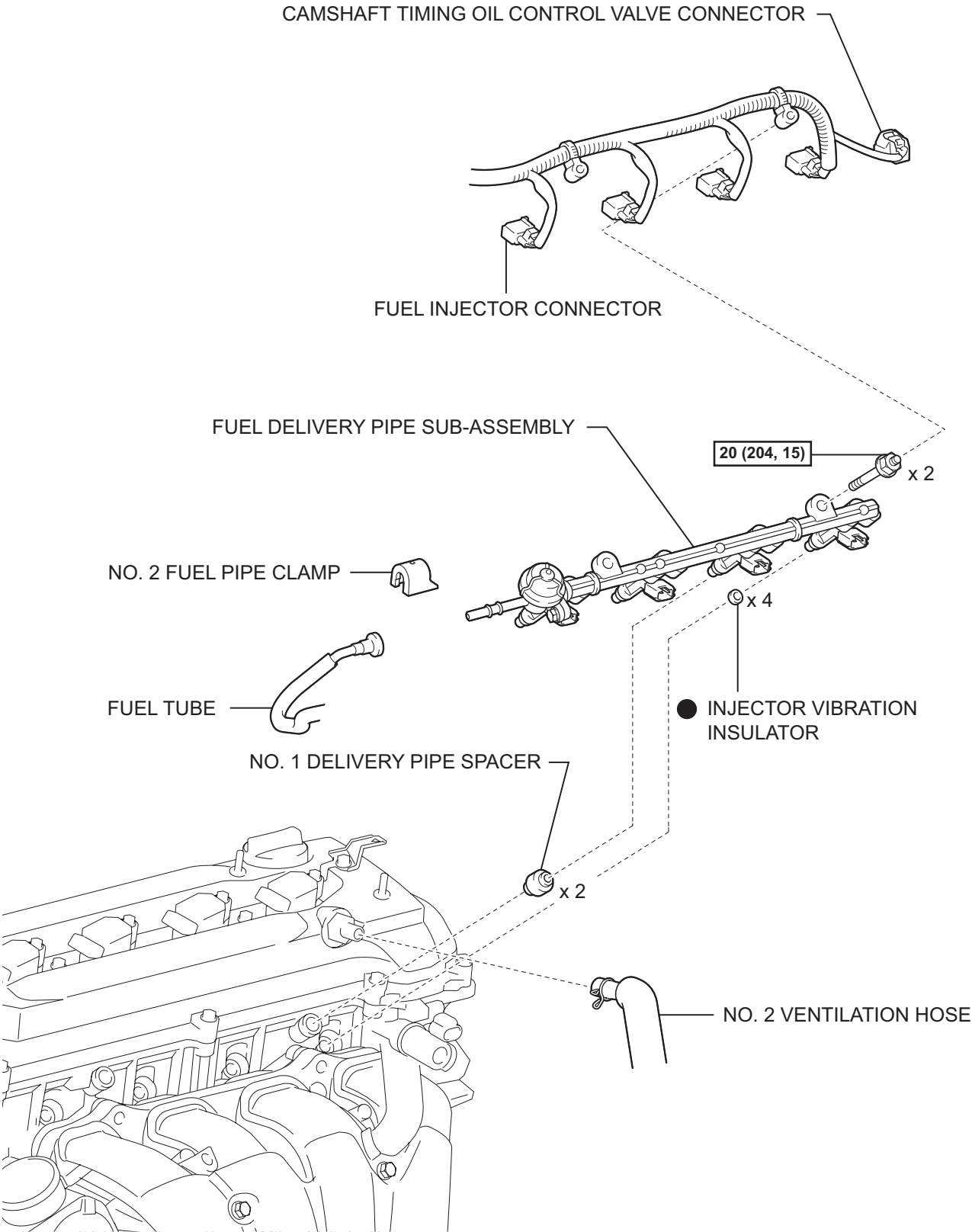
EM





N*m (kgf*cm, ft.*lbf) : Specified torque

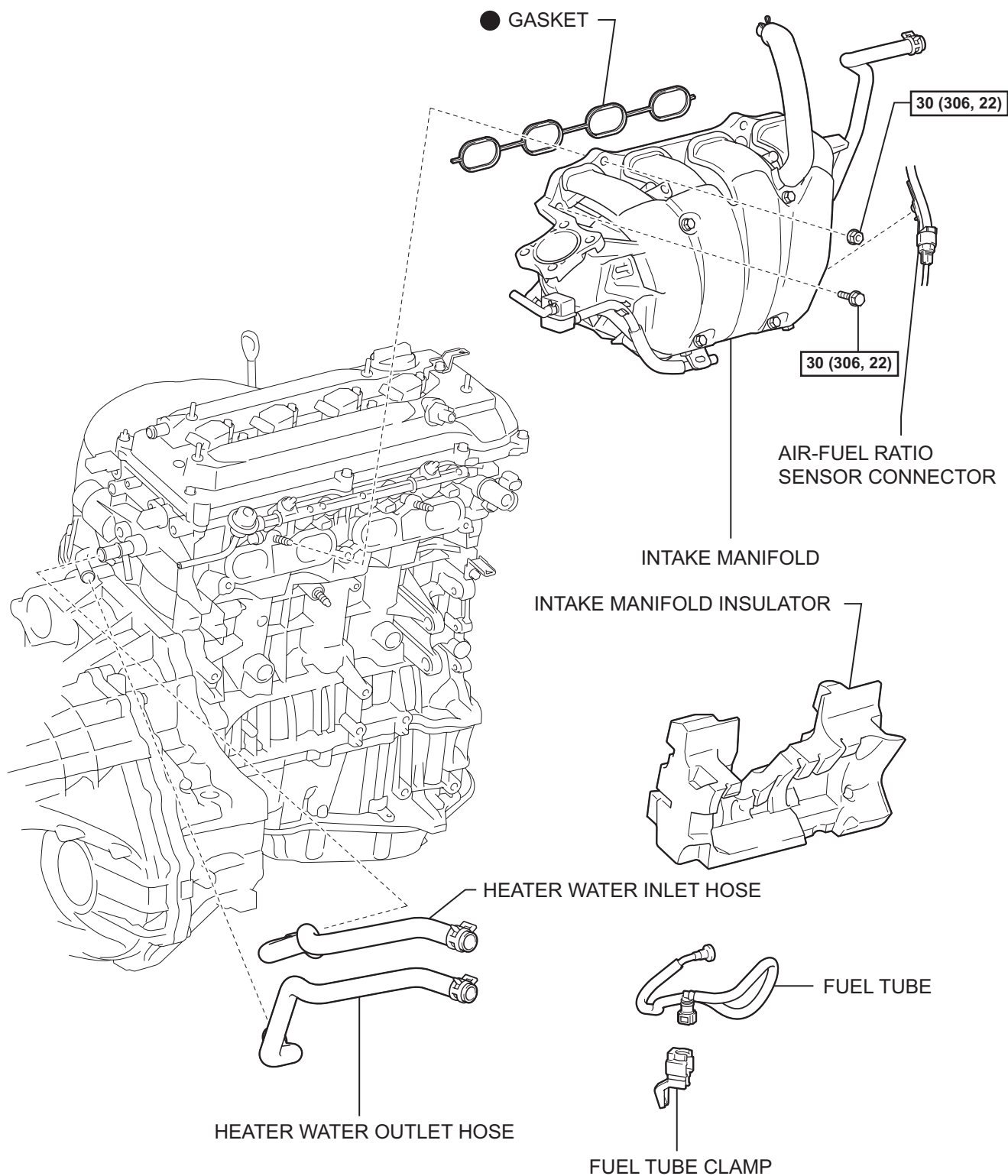
● Non-reusable part



N*m (kgf*cm, ft.*lbf) : Specified torque

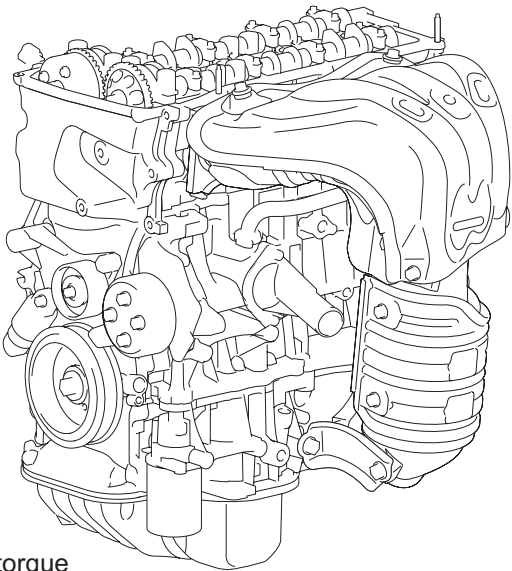
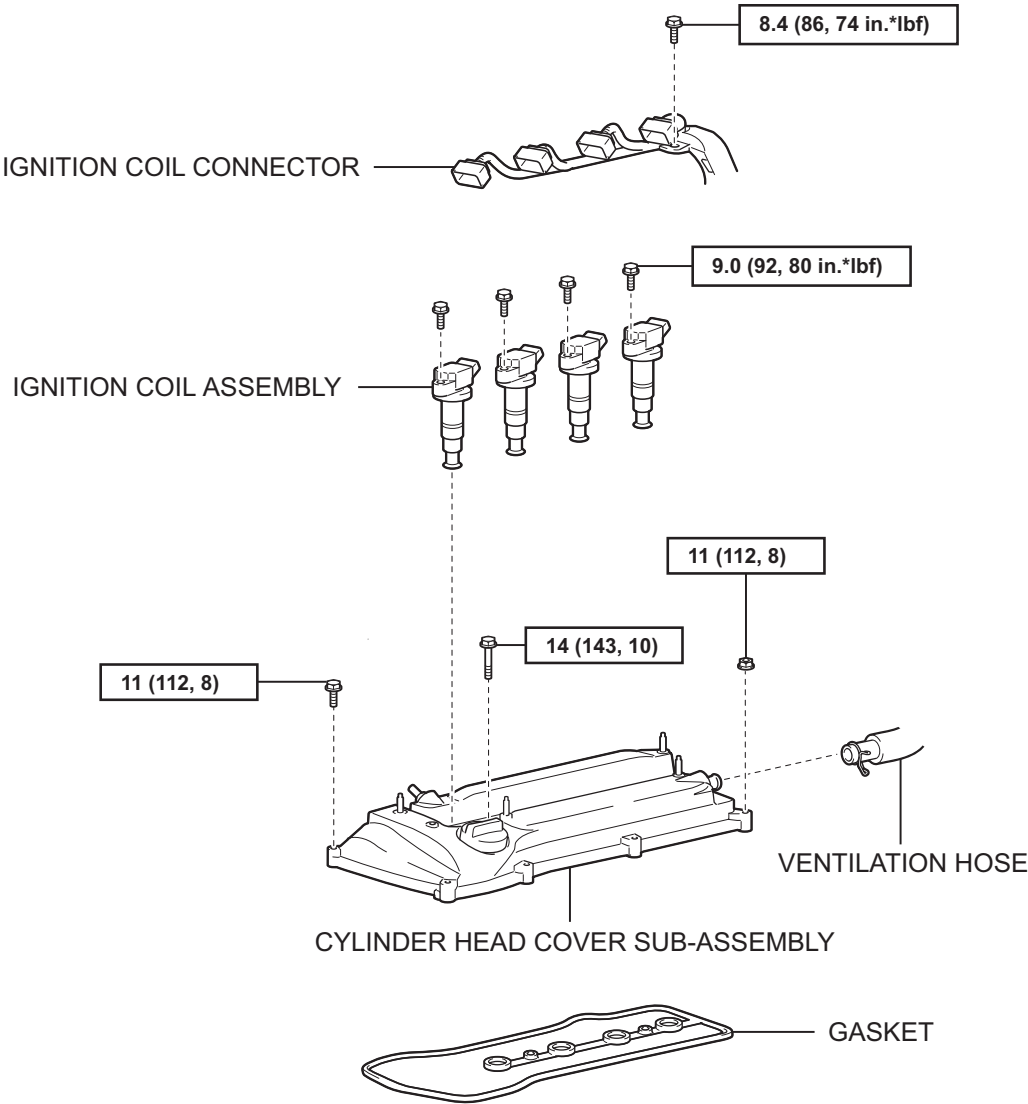
● Non-reusable part

EM



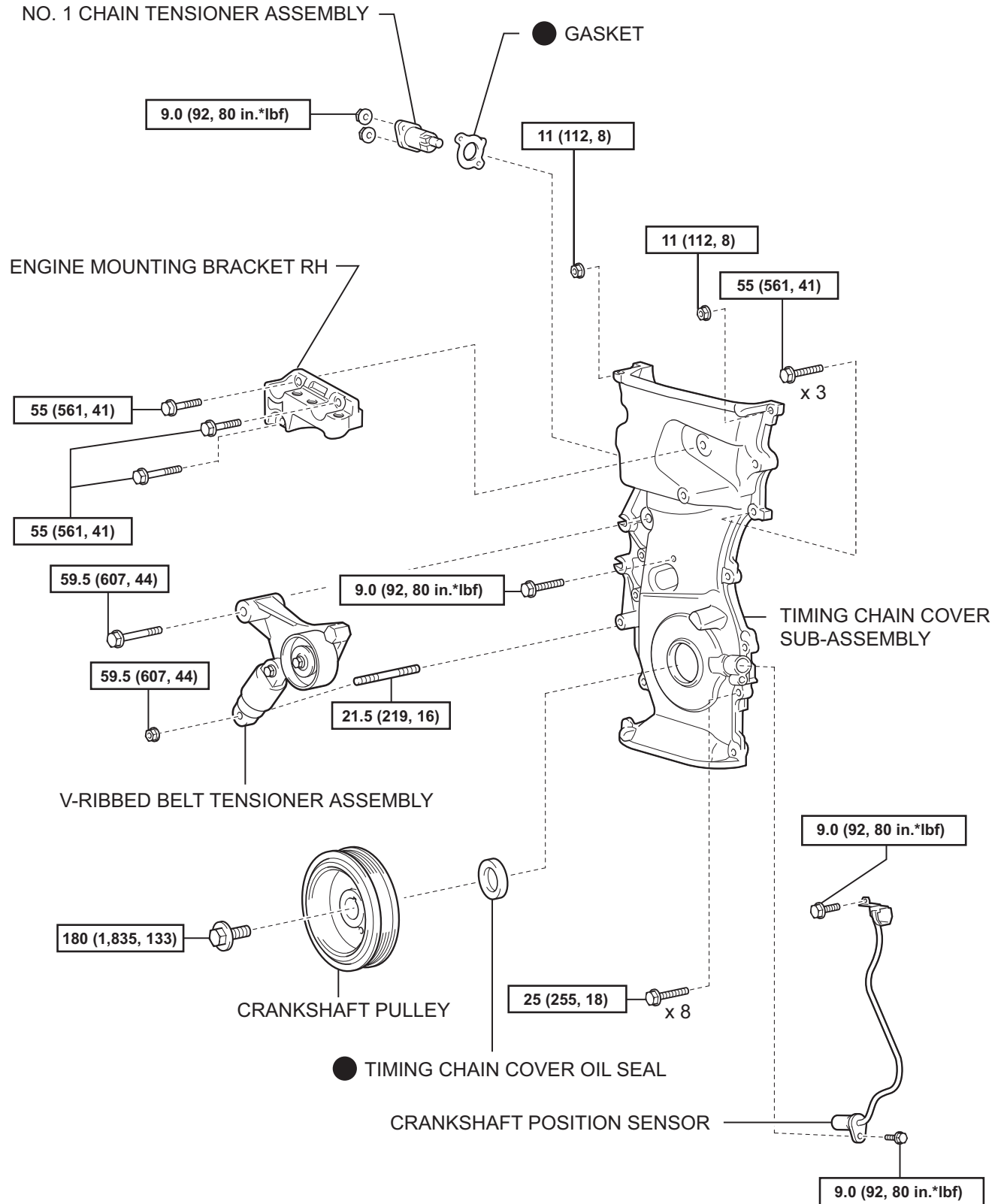
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

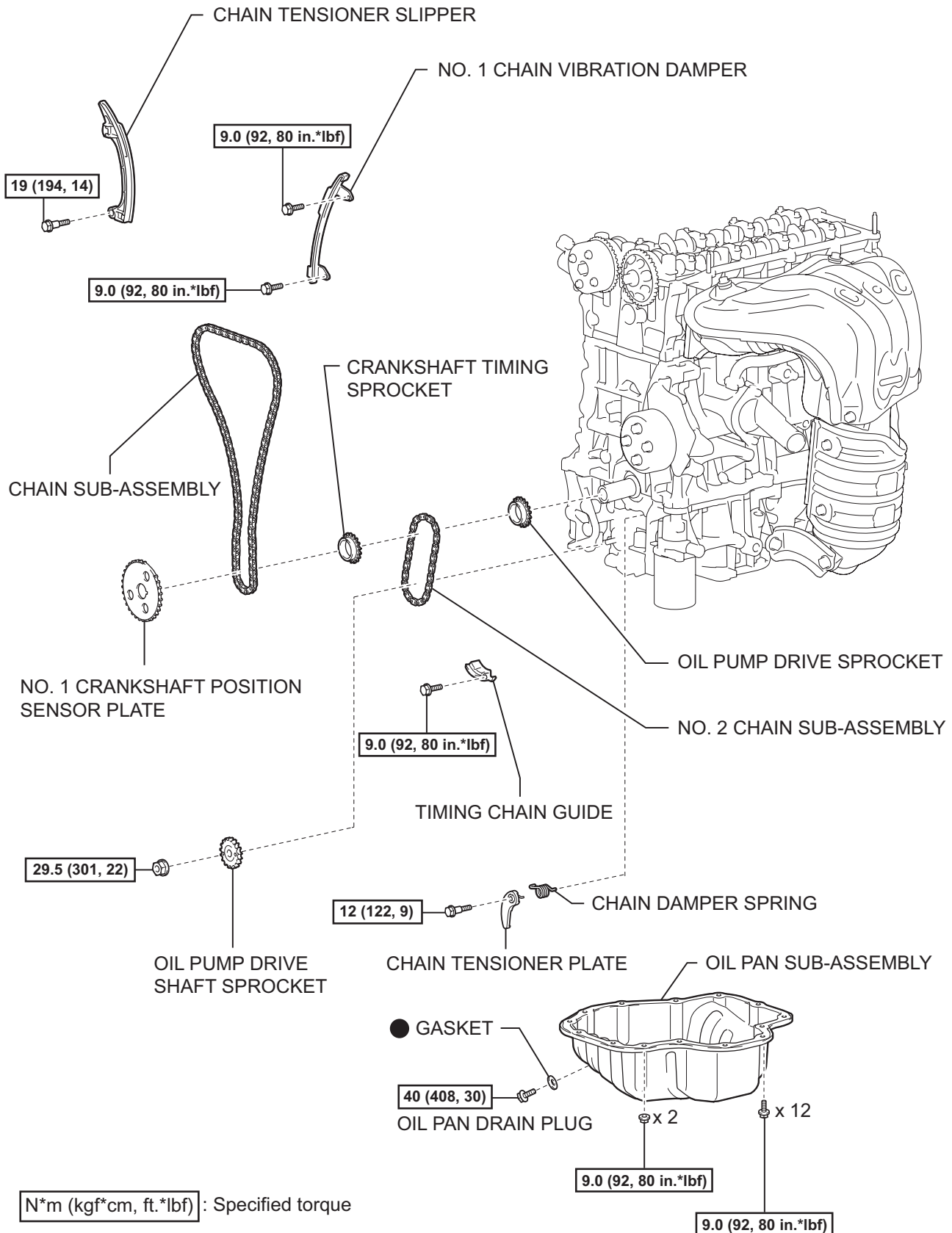


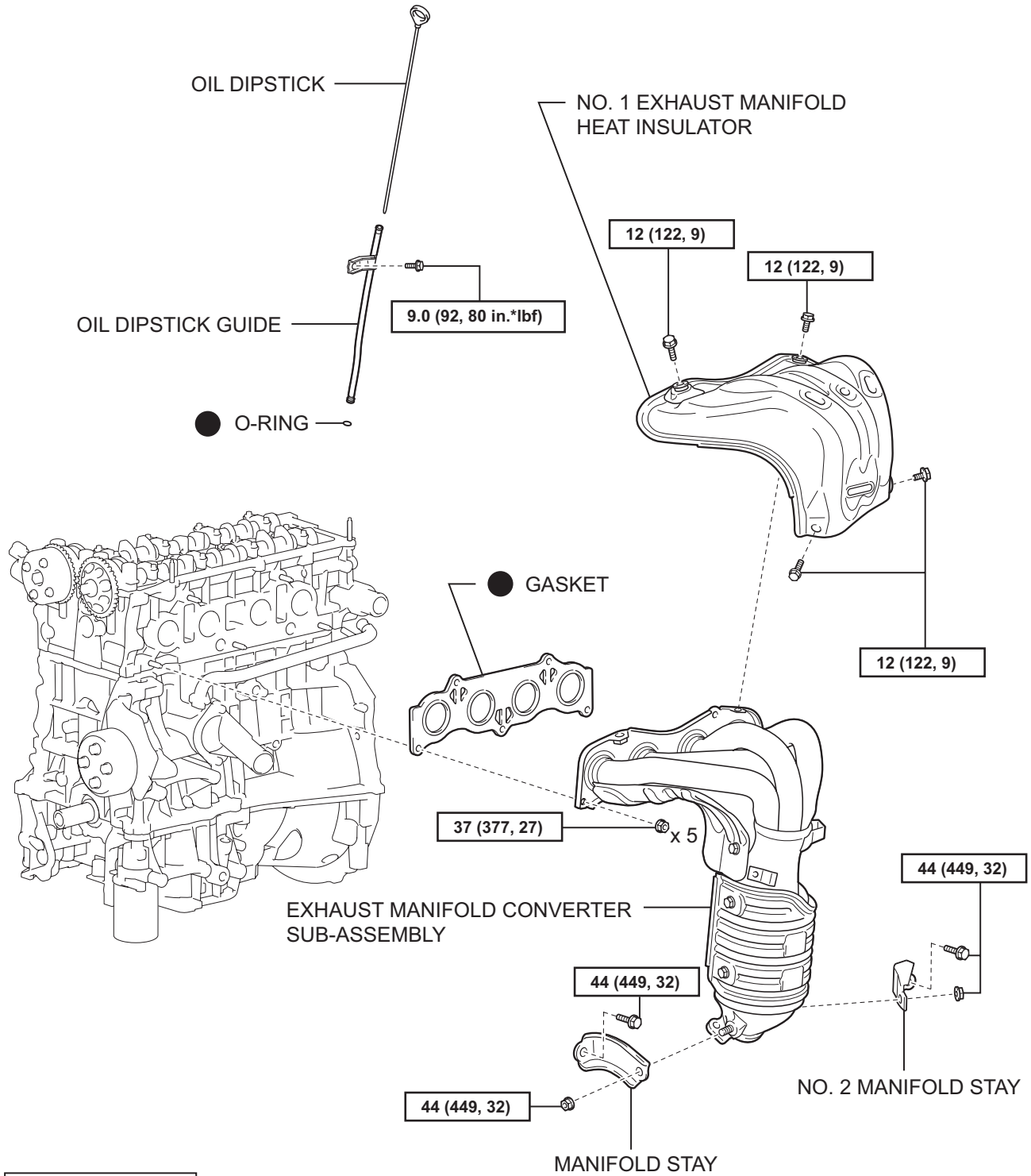
N*m (kgf*cm, ft.*lbf) : Specified torque

EM



EM

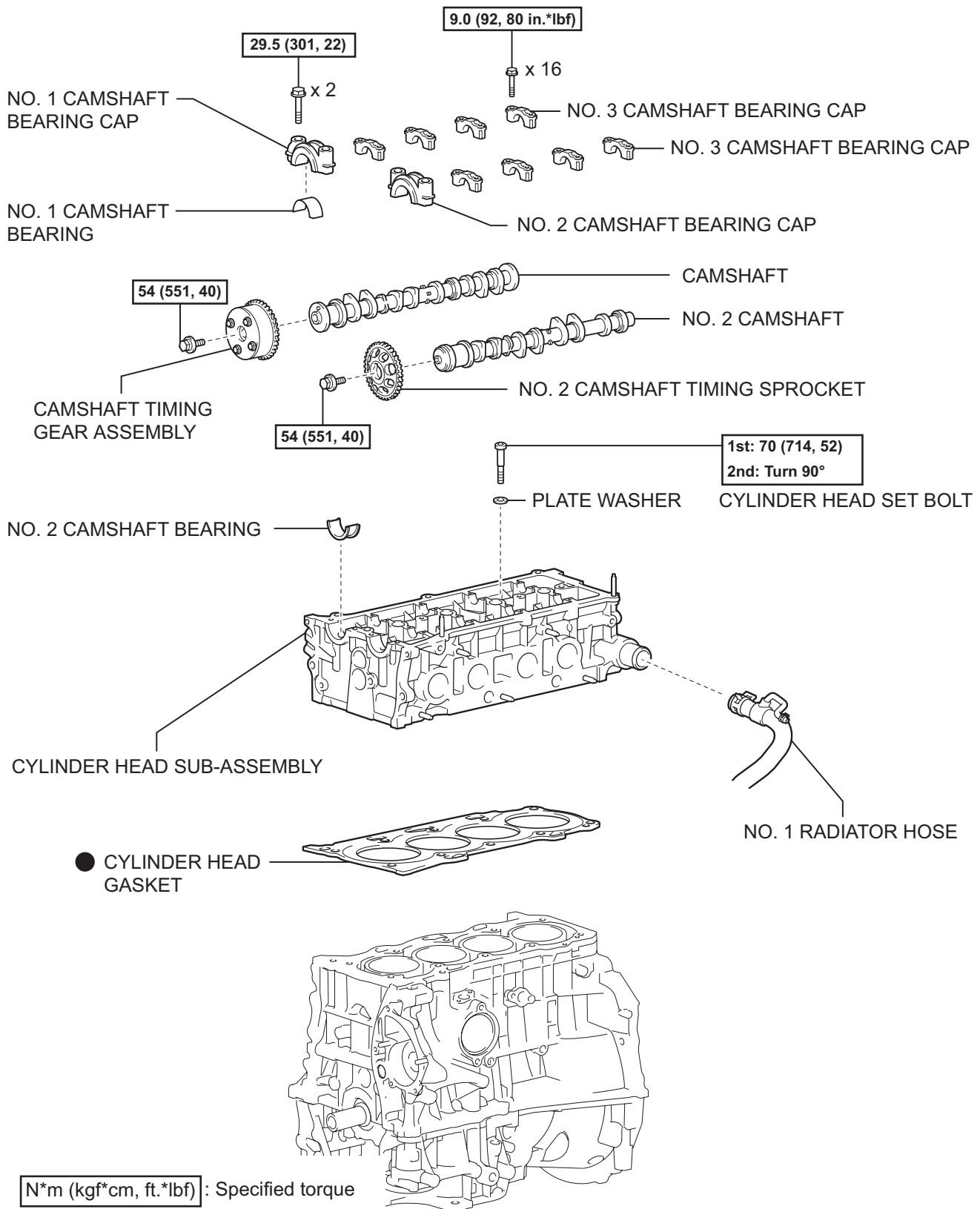


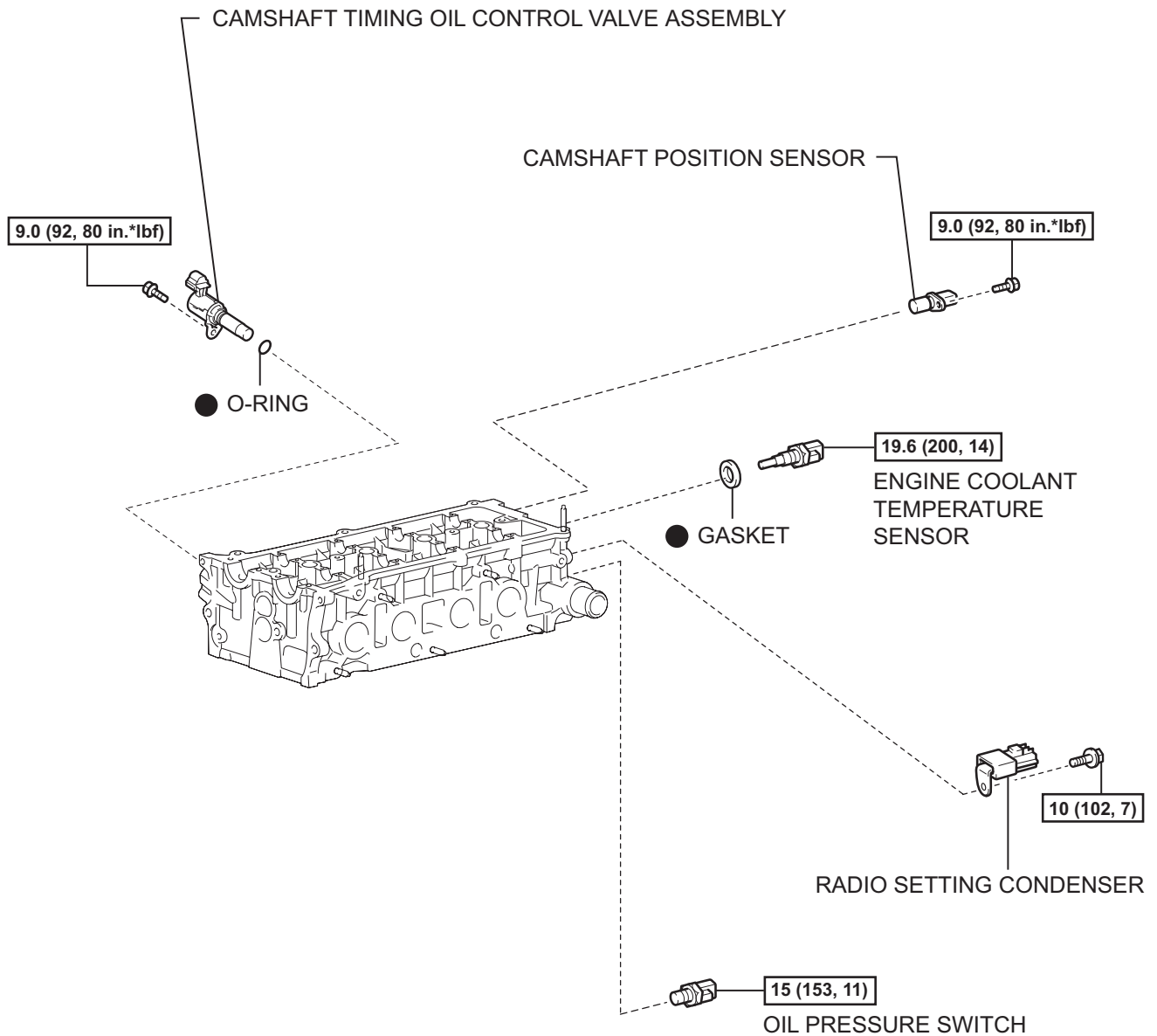


[N*m (kgf*cm, ft.*lbf)] : Specified torque

● Non-reusable part

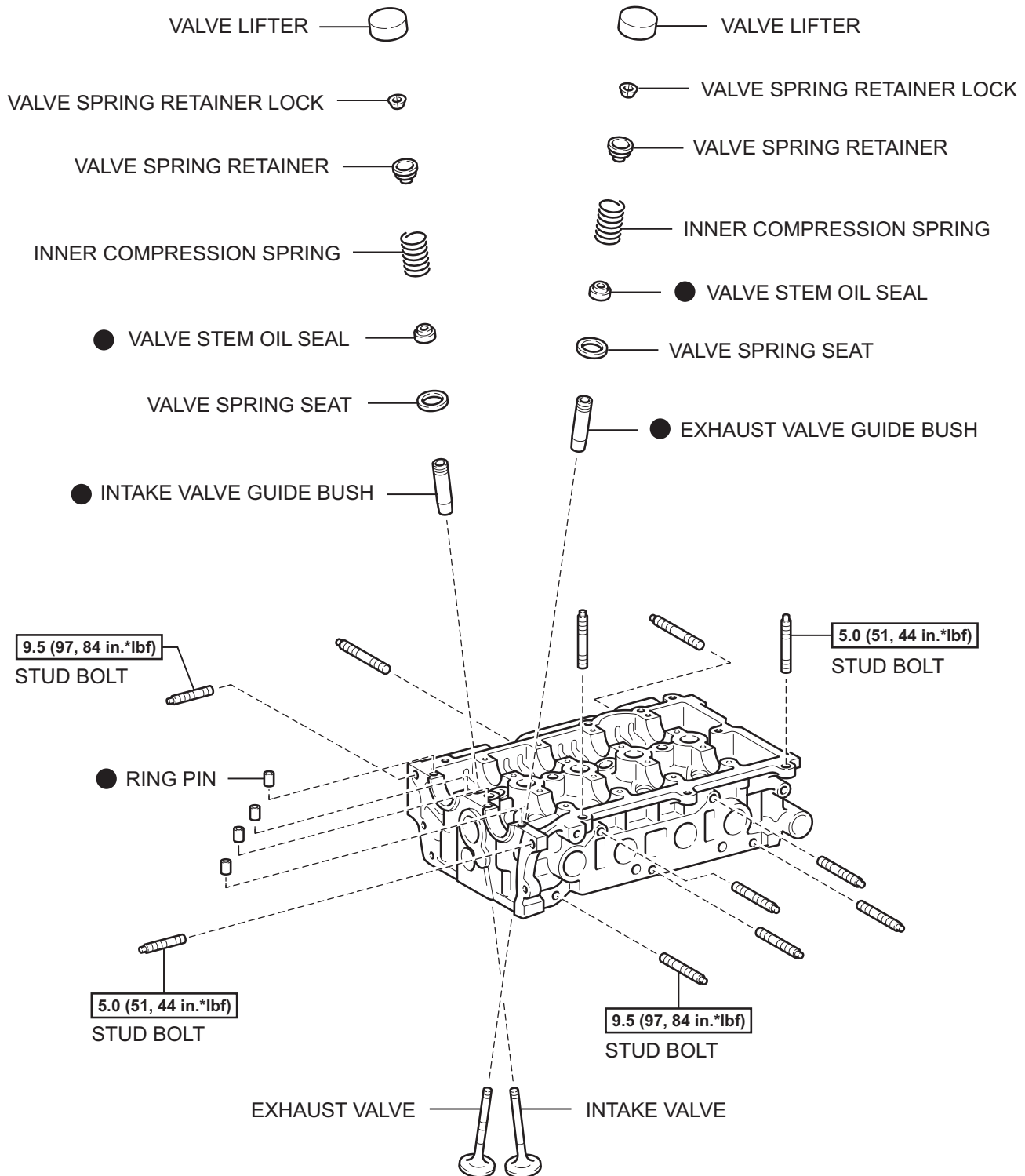
EM





N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

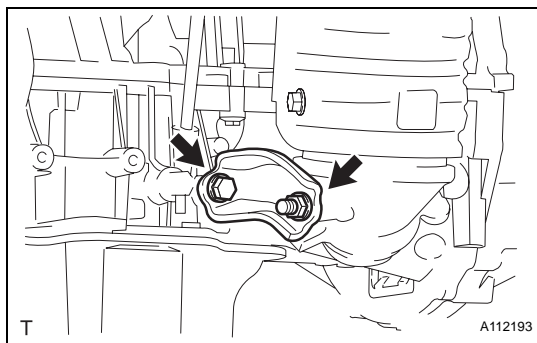
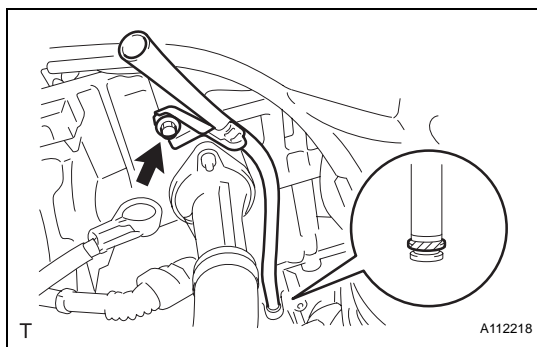


N*m (kgf*cm, ft.*lbf) : Specified torque

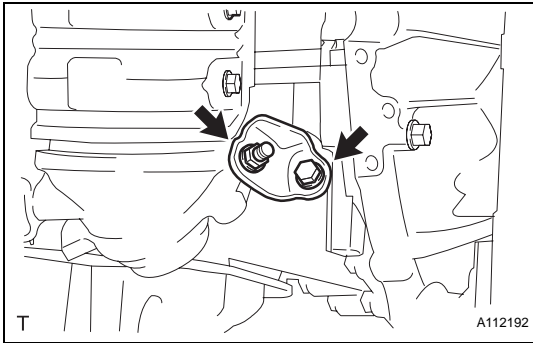
● Non-reusable part

REMOVAL

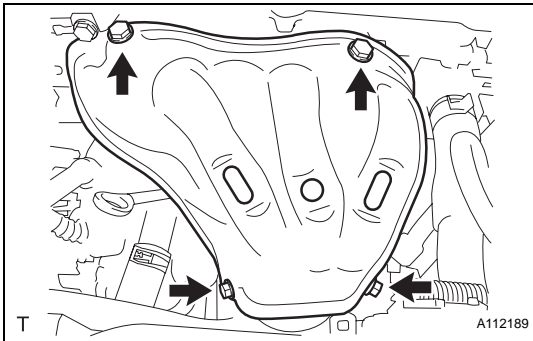
1. DISCHARGE FUEL SYSTEM PRESSURE (See page [FU-9](#))
2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
CAUTION:
Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
3. REMOVE RADIATOR SUPPORT OPENING COVER
4. REMOVE FRONT WHEEL RH
5. REMOVE NO. 1 ENGINE UNDER COVER
6. REMOVE FRONT FENDER APRON RH
7. REMOVE NO. 1 ENGINE COVER (See page [EM-22](#))
8. DRAIN ENGINE COOLANT (See page [CO-6](#))
9. DRAIN ENGINE OIL (See page [LU-4](#))
10. REMOVE AIR CLEANER CAP (See page [ES-411](#))
11. REMOVE THROTTLE BODY (See page [ES-412](#))
12. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY (See page [FU-10](#))
13. REMOVE INTAKE MANIFOLD (See page [ES-419](#))
14. REMOVE INTAKE MANIFOLD INSULATOR (See page [ES-420](#))
15. REMOVE FRONT EXHAUST PIPE (See page [EX-3](#))
16. REMOVE OIL DIPSTICK
17. REMOVE OIL DIPSTICK GUIDE
 - (a) Remove the bolt and guide.
 - (b) Remove the O-ring from the guide.



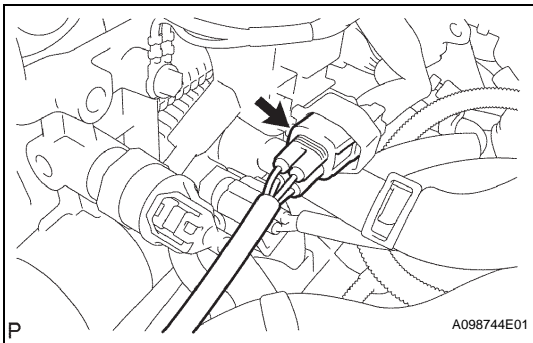
18. REMOVE MANIFOLD STAY
 - (a) Remove the bolt, nut and stay.

**19. REMOVE NO. 2 MANIFOLD STAY**

- (a) Remove the bolt, nut and stay.

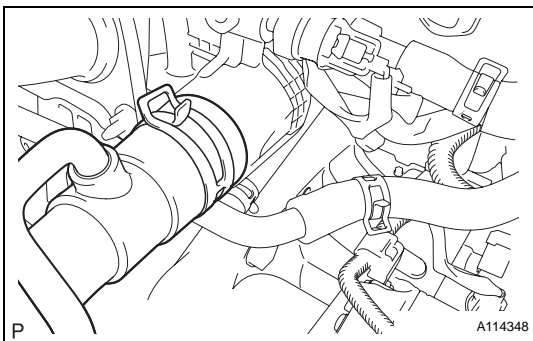
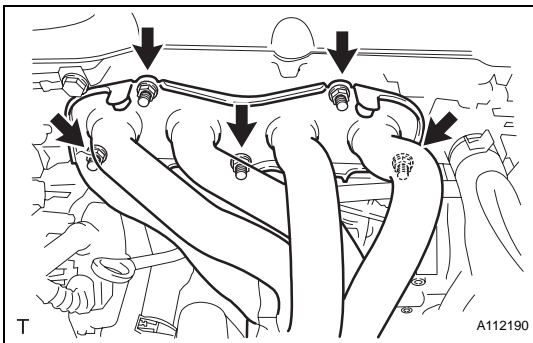
**20. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR**

- (a) Remove the 4 bolts and heat insulator.

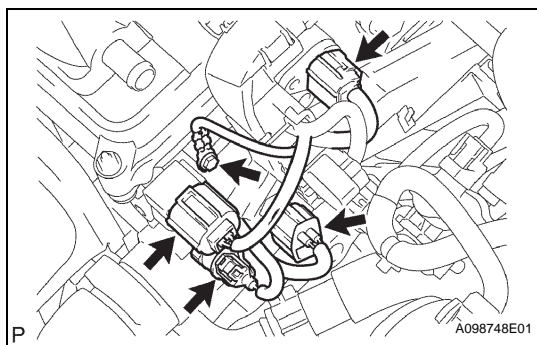
**21. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY**

- (a) Disconnect the air-fuel ratio sensor connector.

- (b) Remove the 5 nuts, manifold converter and gasket.

**22. DISCONNECT NO. 1 RADIATOR HOSE**

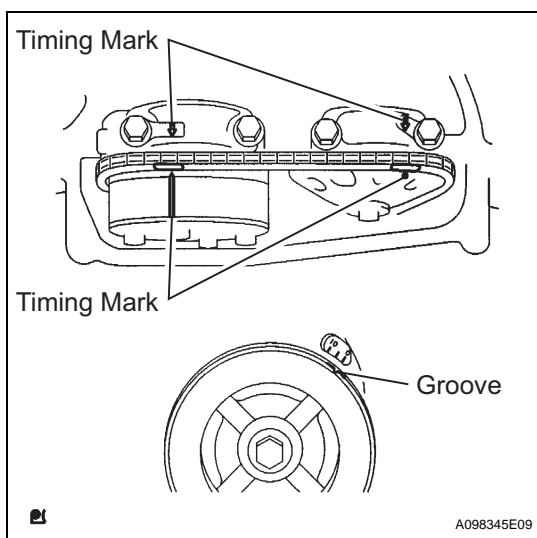
- (a) Disconnect the No. 1 radiator hose.

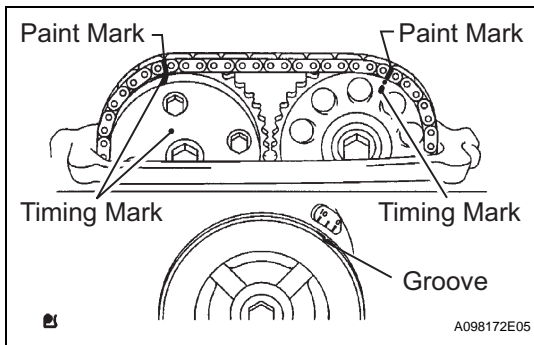
**23. DISCONNECT ENGINE WIRE**

- Disconnect the radio setting condenser connector.
- Disconnect the engine oil pressure switch connector.
- Disconnect the engine coolant temperature sensor connector.
- Disconnect the camshaft position sensor connector.
- Remove the bolt and ground cable.

24. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT RH (See page EM-6)**25. REMOVE FAN AND GENERATOR V BELT (See page EM-6)****26. REMOVE GENERATOR ASSEMBLY (See page CH-9)****27. REMOVE ENGINE MOUNTING INSULATOR RH (See page EM-22)****28. REMOVE IDLER PULLEY (See page EM-23)****29. REMOVE IGNITION COIL ASSEMBLY (See page IG-9)****30. REMOVE SPARK PLUG (See page EM-8)****31. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See page EM-24)****32. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See page EM-26)****33. REMOVE CRANKSHAFT POSITION SENSOR (See page ES-402)****34. REMOVE OIL PAN SUB-ASSEMBLY (See page EM-24)****35. SET NO. 1 CYLINDER TO TDC/COMPRESSION**

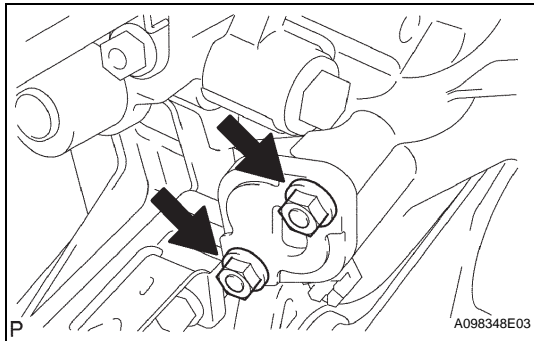
- Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.
- Check that each timing mark of the camshaft timing gear and sprocket is aligned with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration.
If not, turn the crankshaft by 1 revolution (360°) to align the timing marks as above.



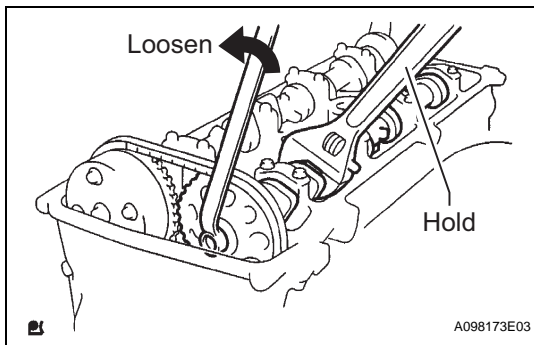


36. REMOVE NO. 2 CAMSHAFT

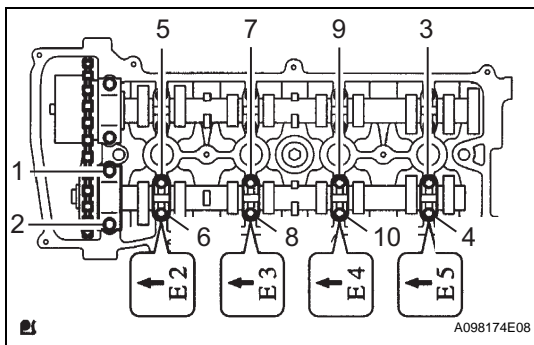
- (a) Place paint marks on the chain in alignment with the timing marks on the camshaft timing gear and camshaft timing sprocket.



- (b) Remove the 2 nuts, tensioner and gasket.

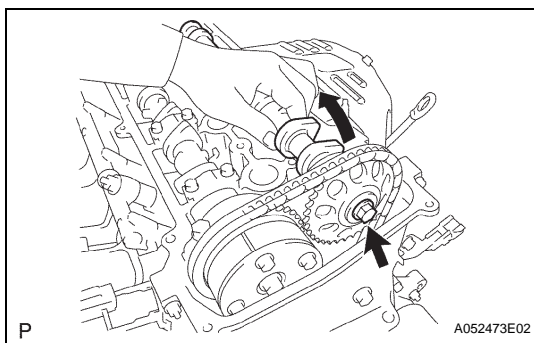


- (c) While holding the camshaft with a wrench, loosen the camshaft timing set bolt.

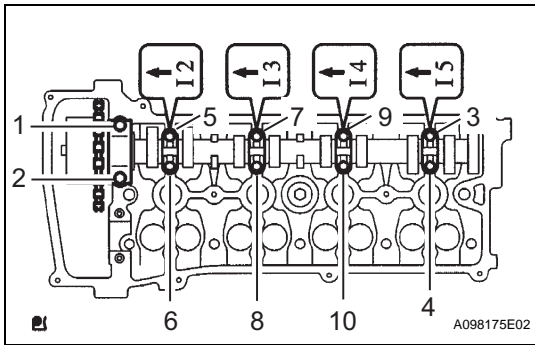


- (d) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

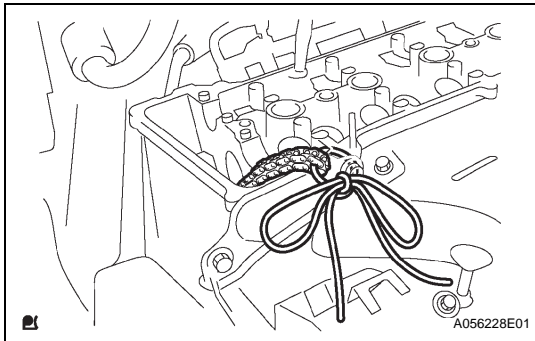
- (e) Remove the 5 bearing caps.



- (f) While holding the No. 2 camshaft by hand, remove the camshaft timing sprocket set bolt.
- (g) Remove the camshaft timing sprocket from the No. 2 camshaft with the timing chain wrapped on the sprocket.
- (h) Remove the camshaft timing sprocket from the timing chain.

**37. REMOVE CAMSHAFT**

- (a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
- (b) Remove the 5 bearing caps.
- (c) Remove the camshaft and camshaft timing gear while holding the timing chain by hand.



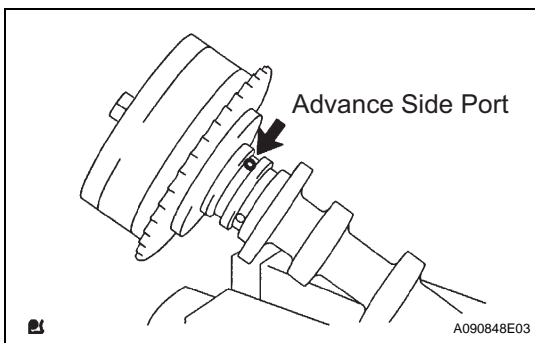
- (d) Tie the timing chain with a string as shown in the illustration.

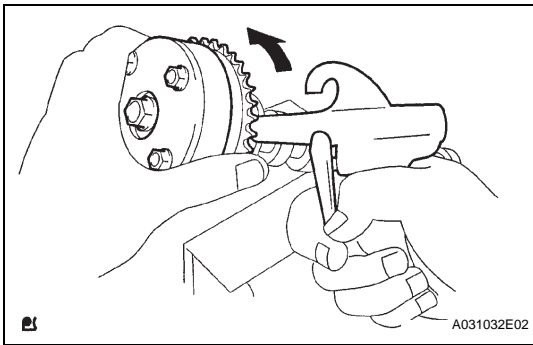
NOTICE:

Be careful not to drop anything inside the timing chain cover.

38. REMOVE CRANKSHAFT PULLEY (See page [EM-25](#))**39. REMOVE ENGINE MOUNTING BRACKET RH (See page [EM-26](#))****40. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY (See page [EM-26](#))****41. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE****42. REMOVE TIMING CHAIN GUIDE (See page [EM-28](#))****43. REMOVE CHAIN TENSIONER SLIPPER (See page [EM-28](#))****44. REMOVE NO. 1 CHAIN VIBRATION DAMPER (See page [EM-28](#))****45. REMOVE CHAIN SUB-ASSEMBLY****46. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page [ES-395](#))****47. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY**

- (a) Clamp the camshaft in a vise, and make sure that the camshaft timing gear does not rotate.
- (b) Cover all the oil ports with vinyl tape except the advance side port shown in the illustration.





- (c) Apply air pressure of 100 kPa (1.0 kgf/cm², 14 psi) to the oil path, then turn the camshaft timing gear to the advance direction (counterclockwise) by hand.

CAUTION:

Cover the paths with a shop rag to avoid oil splashes.

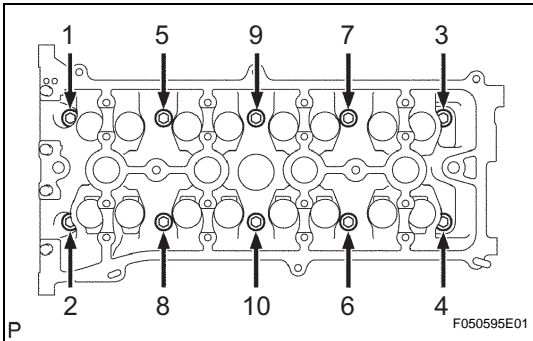
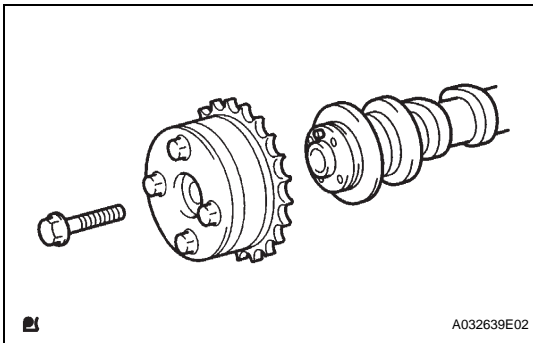
HINT:

Depending on the air pressure, the camshaft timing gear will turn to the advance angle side without applying force by hand. Also, under the condition that the pressure is difficult to apply because of air leakage from the port, there may be the case that the lock pin is difficult to release.

- (d) Remove the flange bolt of the camshaft timing gear.

NOTICE:

- Be sure not to remove the other 4 bolts.
- When reusing the camshaft timing gear, release the straight pin lock first, then install the gear.

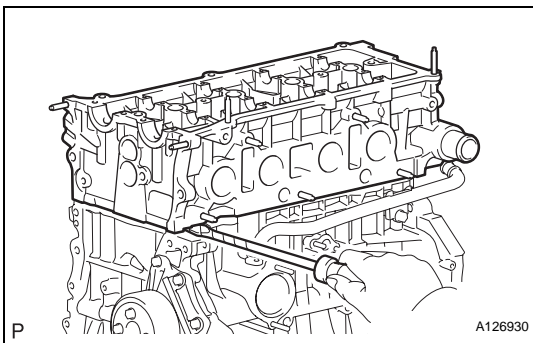


48. REMOVE CYLINDER HEAD SUB-ASSEMBLY

- (a) Using several steps, uniformly loosen and remove the 10 cylinder head bolts and 10 plate washers with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.

NOTICE:

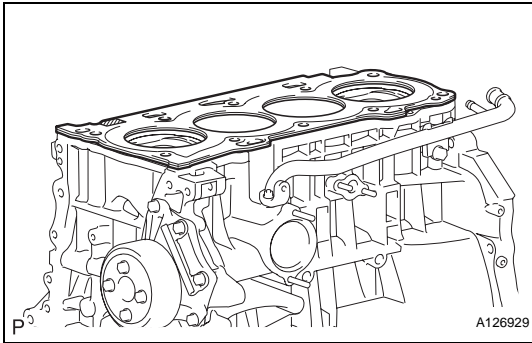
Head warpage or cracking could result from removing the bolts in the wrong order.



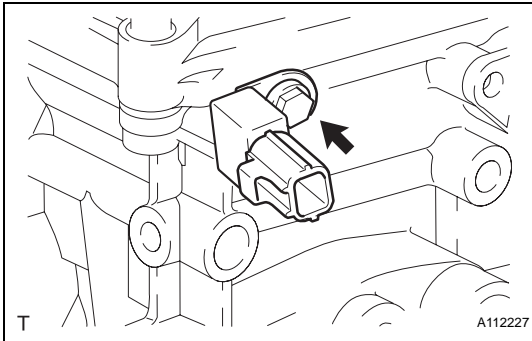
- (b) Using a screwdriver with its tip wrapped with tape, pry between the cylinder head and cylinder block, and remove the cylinder head.

NOTICE:

Be careful not to damage the contact surfaces of the cylinder head and cylinder block.



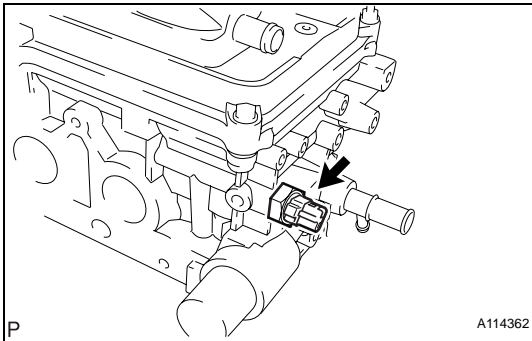
49. REMOVE CYLINDER HEAD GASKET



DISASSEMBLY

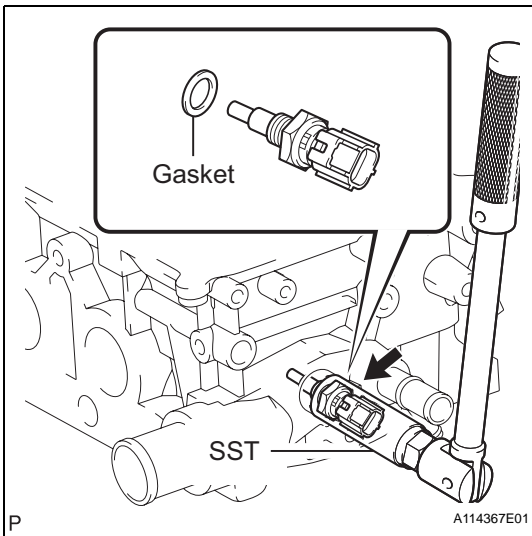
1. REMOVE RADIO SETTING CONDENSER

- (a) Remove the bolt and condenser.



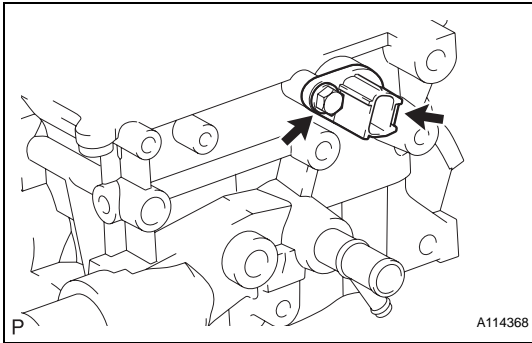
2. REMOVE OIL PRESSURE SWITCH

- (a) Using a 24 mm deep socket wrench, remove the sensor.



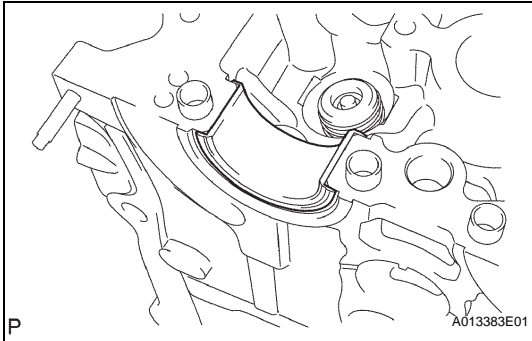
3. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

- (a) Using SST, remove the sensor and gasket.
SST 09817-33190



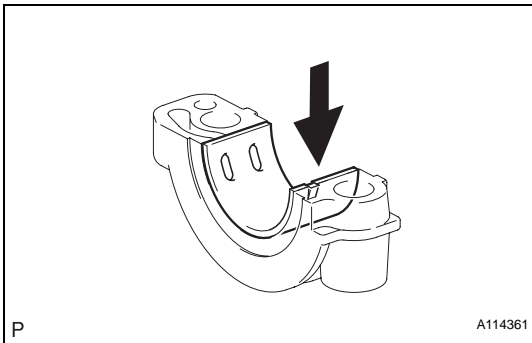
4. REMOVE CAMSHAFT POSITION SENSOR

- (a) Remove the bolt and sensor.



5. REMOVE NO. 2 CAMSHAFT BEARING

- (a) Remove the No. 2 camshaft bearing.



6. REMOVE NO. 1 CAMSHAFT BEARING

- (a) Remove the No. 1 camshaft bearing.

7. REMOVE VALVE LIFTER

HINT:

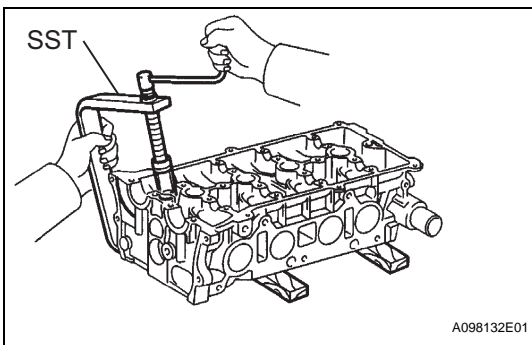
Arrange the valve lifters in the correct order.

8. REMOVE INTAKE VALVE

- (a) Place the cylinder head on wooden blocks.

- (b) Using SST, compress the spring, then remove the 2 retainer locks.

SST 09202-70020 (09202-00010)



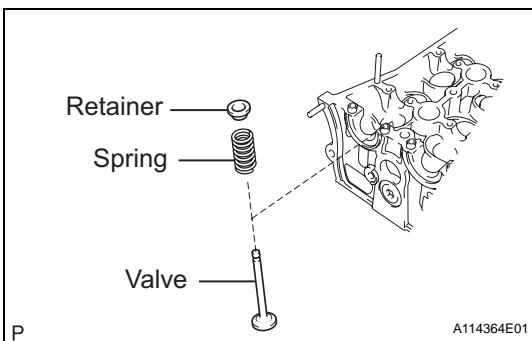
- (c) Remove the retainer, spring and valve from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

9. REMOVE EXHAUST VALVE

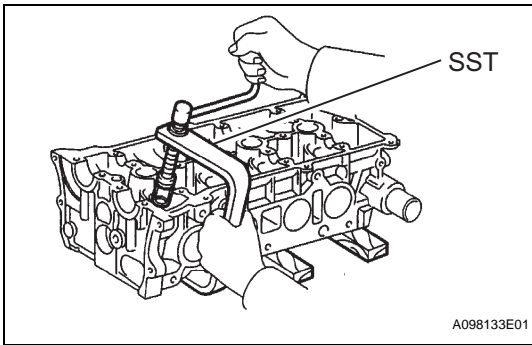
- (a) Place the cylinder head on wooden blocks.



Retainer

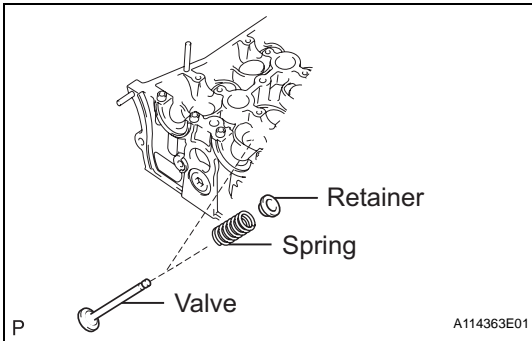
Spring

Valve



- (b) Using SST, compress the spring, then remove the 2 retainer locks.

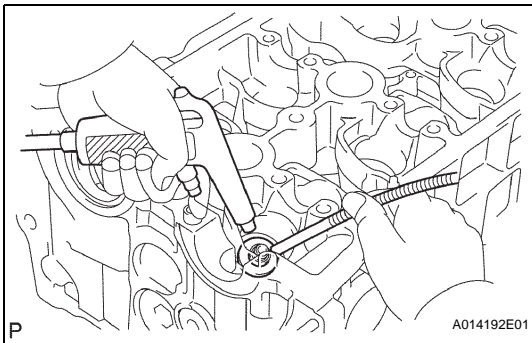
SST 09202-70020 (09202-00010)



- (c) Remove the retainer, spring and valve from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

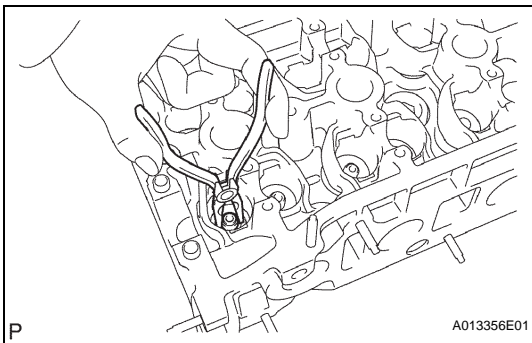


10. REMOVE VALVE SPRING SEAT

- (a) Using compressed air and a magnetic finger, remove the spring seat by blowing air.

HINT:

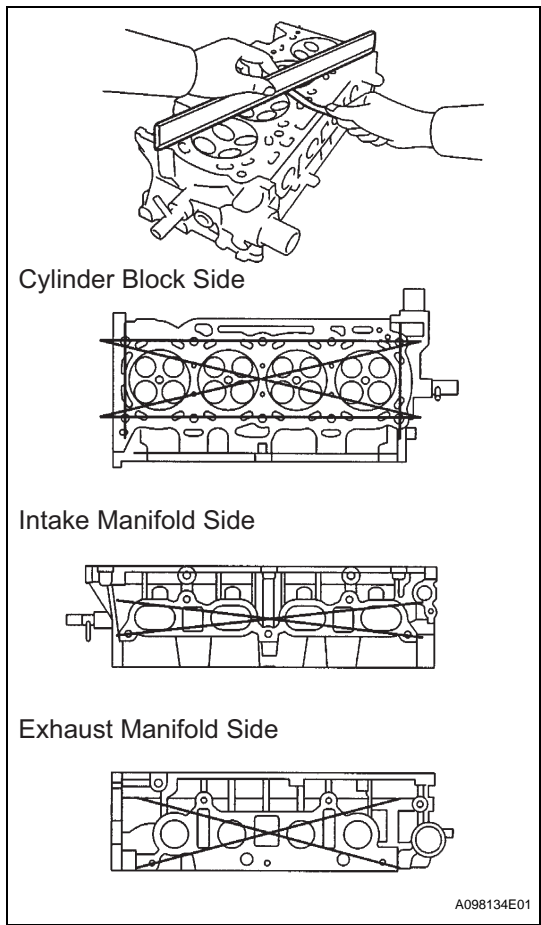
Arrange the valves, valve springs, spring seats and spring retainers in the correct order.



11. REMOVE VALVE STEM OIL SEAL

- (a) Using needle-nose pliers, remove the 16 oil seals.

EM



INSPECTION

1. INSPECT CYLINDER HEAD FOR WARPAGE

- (a) Using a precision straightedge and feeler gauge, measure the warpage of the contact surfaces of the cylinder block and manifolds.

Maximum warpage:

0.08 mm (0.0032 in.)

If the warpage is greater than the maximum, replace the cylinder head sub-assembly.

2. INSPECT CYLINDER HEAD FOR CRACKS

- (a) Using a dye penetrant, inspect the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.
If cracked, replace the cylinder head.

3. INSPECT VALVE SEAT

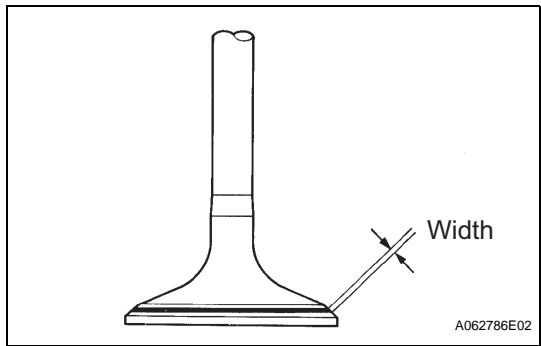
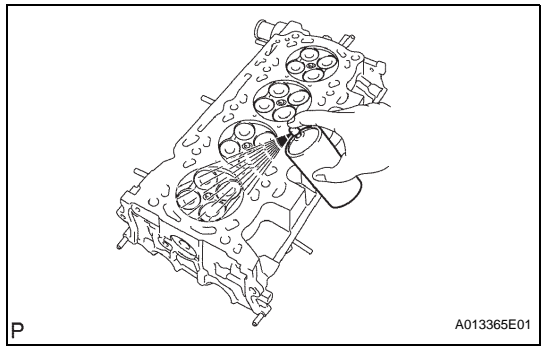
- (a) Apply a light coat of Prussian blue to the valve face.
(b) Lightly press the valve against the seat.

NOTICE:

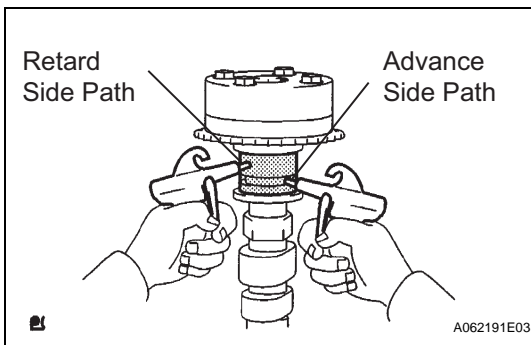
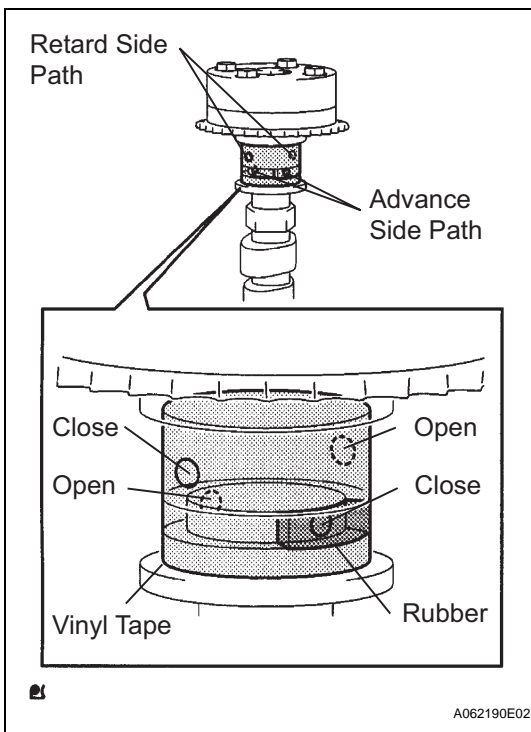
Do not turn the valve.

- (c) Check the valve face and seat in accordance with the following procedure.
- (1) If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
 - (2) If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the valve seat (see page [EM-87](#)).
 - (3) Check that the seat contact is in the middle of the valve face with a width.

Standard width



Item	Standard Condition
Intake	1.0 to 1.4 mm (0.0039 to 0.0551 in.)
Exhaust	1.2 to 1.6 mm (0.0472 to 0.0630 in.)



4. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- (a) Check the lock of the camshaft timing gear.

- (1) Clamp the camshaft in a vise, and confirm that the camshaft timing gear is locked.

NOTICE:

Be careful not to damage the camshaft.

- (b) Release the lock pin.

- (1) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

HINT:

The 2 advance side paths are provided in the groove of the camshaft. Plug one of the paths with a rubber piece.

- (2) Break through the tape of the advance side path and the retard side path on the opposite side of the groove.

- (3) Apply approximately 200 kPa (2.0 kgf/cm², 28 psi) of air pressure to the paths whose tape was broken in the procedure above.

CAUTION:

Some oil spraying will occur. Contain the spray with a shop rag.

- (4) Check that the camshaft timing gear revolves in the advance direction when weakening the air pressure of the retard side path.

OK:

Gear rotates in advance direction.

HINT:

This operation releases the lock pin for the extreme retard position.

- (5) When the camshaft timing gear reaches the extreme advance position, remove the air gun from the retard side path and advance side path, in that order.

NOTICE:

Do not remove the air gun from the advance side path first. The gear may abruptly shift in the retard direction and break the lock pin.

- (c) Check for smooth rotation.

- (1) Rotate the camshaft timing gear within its movable range several times, but do not turn it to the extreme retard position. Check that the gear rotates smoothly.

OK:

Gear rotates smoothly.

NOTICE:

Do not use an air gun to perform the smooth operation check.

- (d) Check the lock in the extreme retard position.
 (1) Confirm that the camshaft timing gear is locked at the extreme retard position.

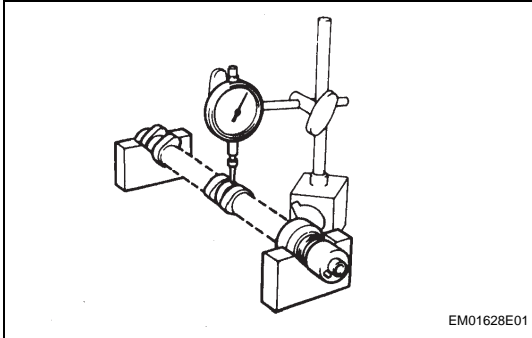
5. INSPECT CAMSHAFT

- (a) Inspect the camshaft for runout.
 (1) Place the camshaft on V-blocks.
 (2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:

0.03 mm (0.0012 in.)

If the circle runout is greater than the maximum, replace the camshaft.



- (b) Inspect the cam lobes.

- (1) Using a micrometer, measure the cam lobe height.

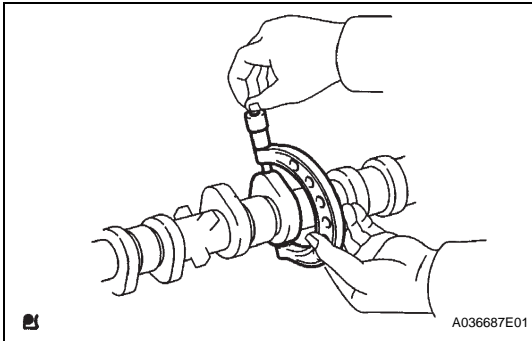
Standard cam lobe height:

47.306 to 47.406 mm (1.8624 to 1.8664 in.)

Minimum cam lobe height:

47.196 mm (1.8581 in.)

If the cam lobe height is less than the minimum, replace the camshaft.



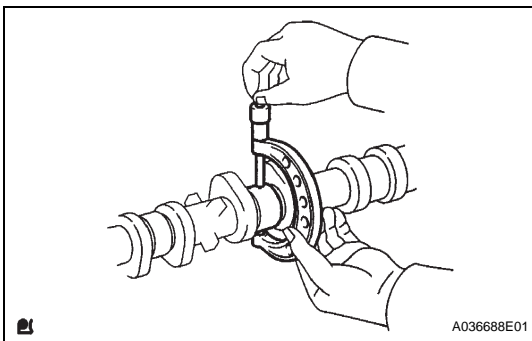
- (c) Inspect the camshaft journals.

- (1) Using a micrometer, measure the journal diameter.

Standard journal diameter

Journal Position	Specified Condition
No. 1	35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Other	22.959 to 22.975 mm (0.9039 to 0.9045 in.)

If the journal diameter is not as specified, check the oil clearance.

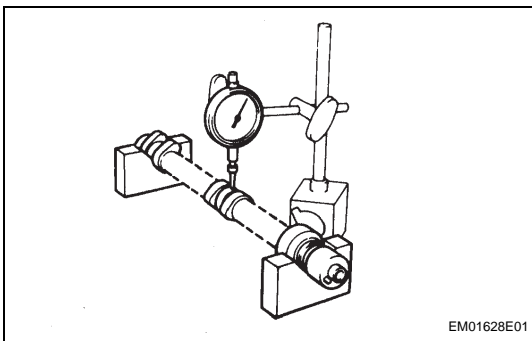
**6. INSPECT NO. 2 CAMSHAFT**

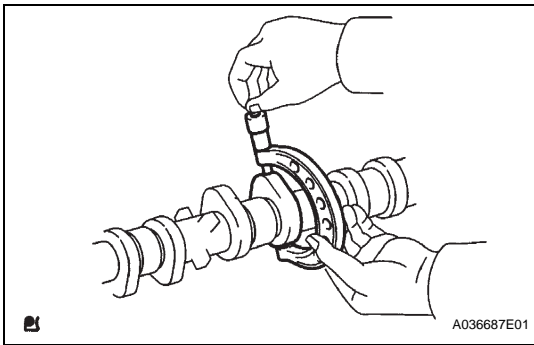
- (a) Inspect the camshaft for runout.
 (1) Place the camshaft on V-blocks.
 (2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:

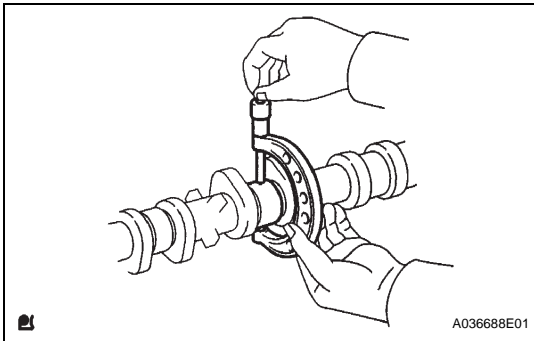
0.03 mm (0.0012 in.)

If the circle runout is greater than the maximum, replace the No. 2 camshaft.





- (b) Inspect the cam lobes.
- (1) Using a micrometer, measure the cam lobe height.
- Standard cam lobe height:**
45.983 to 46.083 mm (1.8104 to 1.8143 in.)
- Minimum cam lobe height:**
45.873 mm (1.8060 in.)
- If the cam lobe height is less than the minimum, replace the No. 2 camshaft.

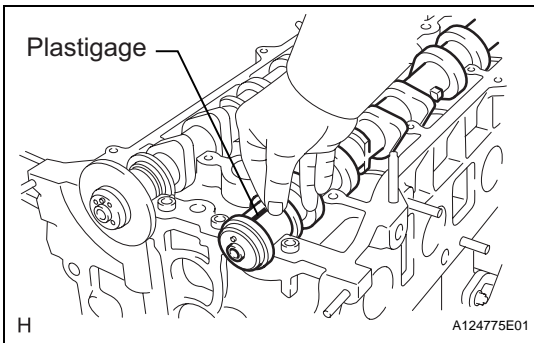


- (c) Inspect the camshaft journals.
- (1) Using a micrometer, measure the journal diameter.

Standard journal diameter

Journal Position	Specified Condition
No. 1	35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Other	22.959 to 22.975 mm (0.9039 to 0.9045 in.)

If the journal diameter is not as specified, check the oil clearance.



7. INSPECT CAMSHAFT OIL CLEARANCE

- (a) Clean the 10 bearing caps and camshaft journals.
- (b) Place the 2 camshafts on the cylinder head.
- (c) Lay a strip of Plastigage across each of the camshaft journals.
- (d) Install the 10 bearing caps (see page EM-84).
- NOTICE:**
Do not turn the camshaft.
- (e) Remove the 10 bearing caps for the No. 2 camshaft (see page EM-60) and camshaft (see page EM-61).

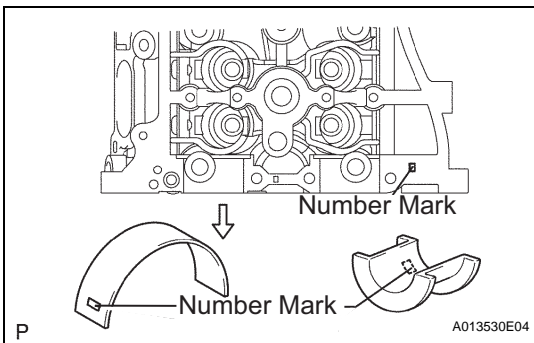
- (f) Measure the Plastigage at its widest point.
- Standard oil clearance**

Item	Standard Condition
Intake No. 1 journal	0.007 to 0.038 mm (0.0003 to 0.0015 in.)
Exhaust No. 1 journal	0.040 to 0.079 mm (0.0016 to 0.0031 in.)
Other journal	0.025 to 0.062 mm (0.0010 to 0.0024 in.)

Maximum oil clearance

Item	Standard Condition
Intake No. 1 journal	0.07 mm (0.0028 in.)
Other journal	0.10 mm (0.0039 in.)

NOTICE:
Completely remove the Plastigage after the measurement.



If the oil clearance on the No. 1 journal is greater than the maximum, choose a new bearing and install it.

If the oil clearance on the other journals is greater than the maximum, replace the cylinder head sub-assembly or the camshaft.

Standard cylinder head journal bore diameter

Mark	Standard Condition
Mark 1	40.000 to 40.008 mm (1.5748 to 1.5751 in.)
Mark 2	40.009 to 40.017 mm (1.5752 to 1.5755 in.)
Mark 3	40.018 to 40.025 mm (1.5755 to 1.5758 in.)

Standard bearing center wall thickness

Mark	Standard Condition
Mark 1	2.000 to 2.004 mm (0.0787 to 0.0789 in.)
Mark 2	2.005 to 2.008 mm (0.0789 to 0.0791 in.)
Mark 3	2.009 to 2.012 mm (0.0791 to 0.0792 in.)

Standard camshaft journal diameter:

35.971 to 35.985 mm (1.4162 to 1.4167 in.)

8. INSPECT CAMSHAFT THRUST CLEARANCE

- Install the 2 camshafts (see page [EM-84](#)).
- Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance

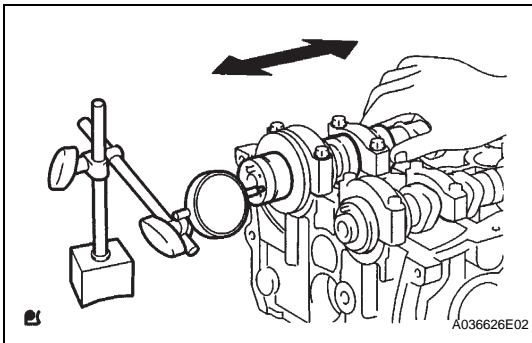
Item	Standard Condition
Intake	0.040 to 0.095 mm (0.0016 to 0.0037 in.)
Exhaust	0.080 to 0.135 mm (0.0032 to 0.0053 in.)

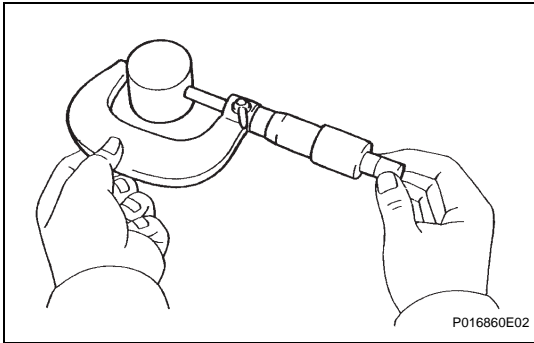
Maximum thrust clearance

Item	Standard Condition
Intake	0.11 mm (0.0043 in.)
Exhaust	0.15 mm (0.0059 in.)

If the thrust clearance is greater than the maximum, replace the cylinder head.

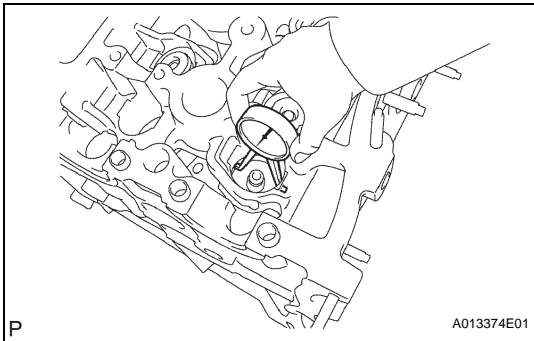
If damage is found on the camshaft thrust surfaces, replace the camshaft.





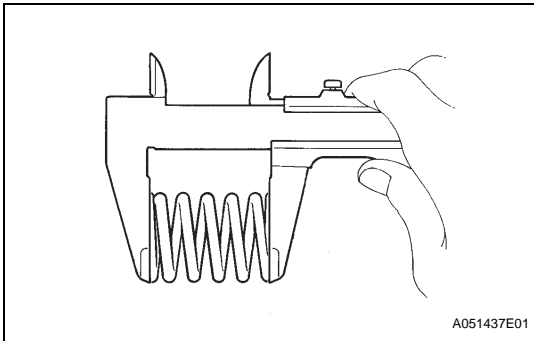
9. INSPECT VALVE LIFTER

- (a) Using a micrometer, measure the lifter diameter.
Standard lifter diameter:
30.966 to 30.976 mm (1.2191 to 1.2195 in.)
 If the diameter is not as specified, replace the valve lifter.



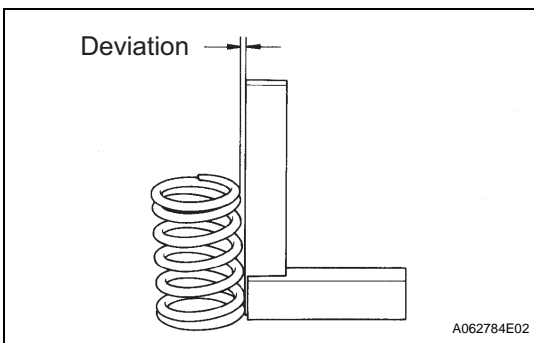
10. INSPECT VALVE LIFTER OIL CLEARANCE

- (a) Using a caliper gauge, measure the valve lifter bore diameter of the cylinder head.
Standard lifter bore diameter:
31.009 to 31.025 mm (1.2208 to 1.2215 in.)
 If the diameter is not as specified, replace the cylinder head sub-assembly.
- (b) Subtract the valve lifter diameter measurement from the valve lifter bore diameter measurement.
Standard oil clearance:
0.033 to 0.059 mm (0.0013 to 0.0023 in.)
Maximum oil clearance:
0.079 mm (0.0031 in.)
 If the oil clearance is greater than the maximum, replace the valve lifter. If necessary, replace the cylinder head sub-assembly.

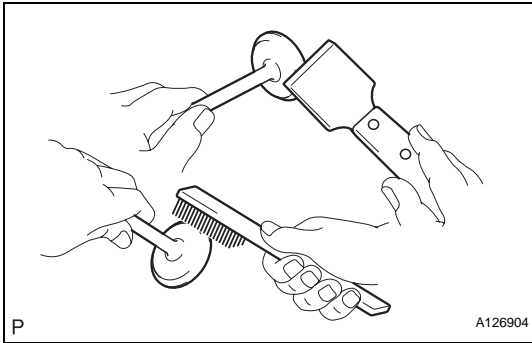


11. INSPECT INNER COMPRESSION SPRING

- (a) Using a vernier caliper, measure the free length of the valve spring.
Standard free length:
47.43 mm (1.8673 in.)
 If the length is not as specified, replace the inner compression spring.

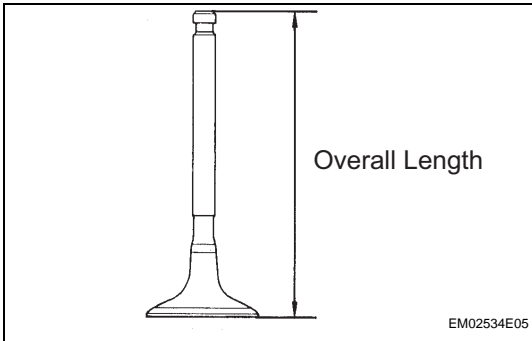


- (b) Using a steel square, measure the deviation of the inner compression spring.
Maximum deviation:
1.6 mm (0.063 in.)
Maximum angle (Reference):
2°
 If the deviation is greater than the maximum, replace the inner compression spring.



12. INSPECT INTAKE VALVE

- Using a gasket scraper, chip off any carbon on the valve head.
- Using a wire brush, thoroughly clean the valve.



- Using a vernier caliper, measure the valve overall length.

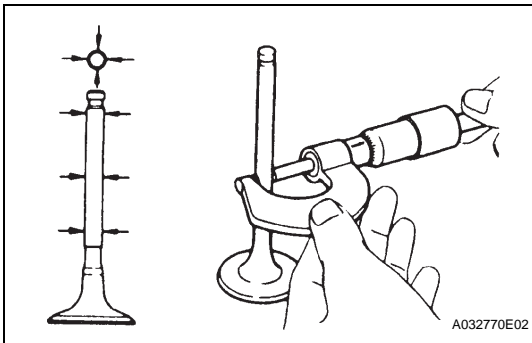
Standard overall length:

101.71 mm (4.0043 in.)

Minimum overall length:

101.21 mm (3.9846 in.)

If the overall length is less than the minimum, replace the intake valve.

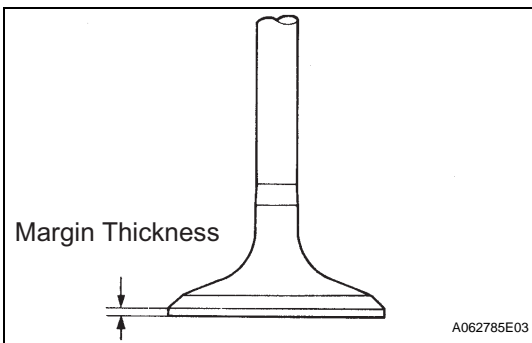


- Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter:

5.470 to 5.485 mm (0.2154 to 0.2159 in.)

If the diameter is not as specified, replace the intake valve.



- Using a vernier caliper, measure the valve head margin thickness.

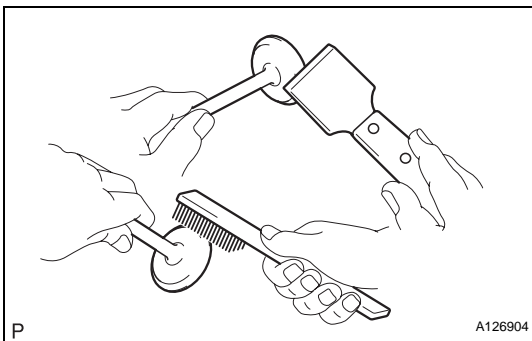
Standard margin thickness:

1.25 mm (0.0492 in.)

Minimum margin thickness:

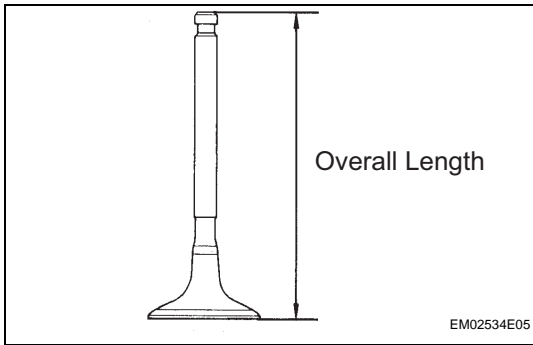
1.05 mm (0.0413 in.)

If the diameter is not as specified, replace the intake valve.



13. INSPECT EXHAUST VALVE

- Using a gasket scraper, chip off any carbon on the valve head.
- Using a wire brush, thoroughly clean the valve.



- (c) Using a vernier caliper, measure the valve overall length.

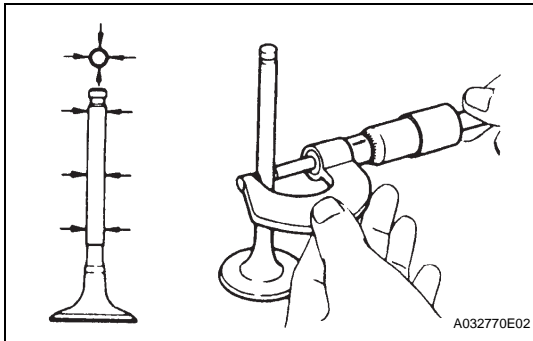
Standard overall length:

101.15 mm (3.9823 in.)

Minimum overall length:

100.70 mm (3.9646 in.)

If the overall length is less than the minimum, replace the exhaust valve.

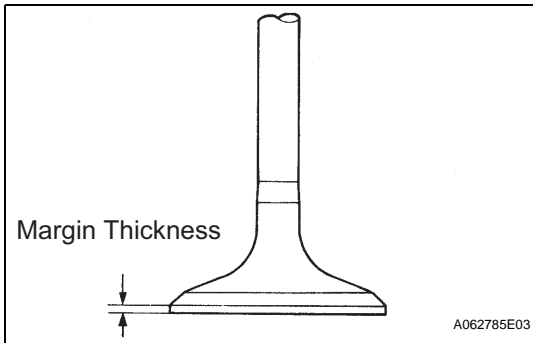


- (d) Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter:

5.465 to 5.480 mm (0.2152 to 0.2158 in.)

If the overall length is less than the minimum, replace the exhaust valve.



- (e) Using a vernier caliper, measure the valve head margin thickness.

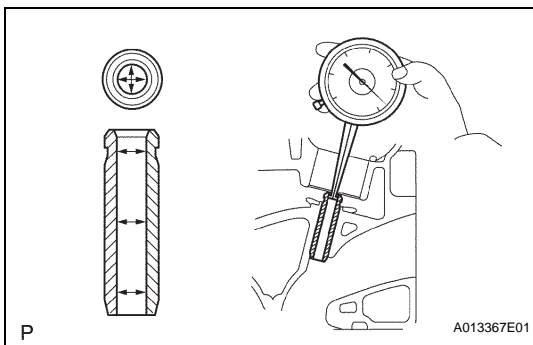
Standard margin thickness:

1.40 mm (0.0551 in.)

Minimum margin thickness:

1.20 mm (0.0472 in.)

If the overall length is less than the minimum, replace the exhaust valve.



14. INSPECT INTAKE VALVE GUIDE BUSH

- (a) Using a caliper gauge, measure the inside diameter of the guide bush.

Standard bush inside diameter:

5.510 to 5.530 mm (0.2169 to 0.2177 in.)

If the inside diameter is not as specified, replace the intake valve guide bush.

- (b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

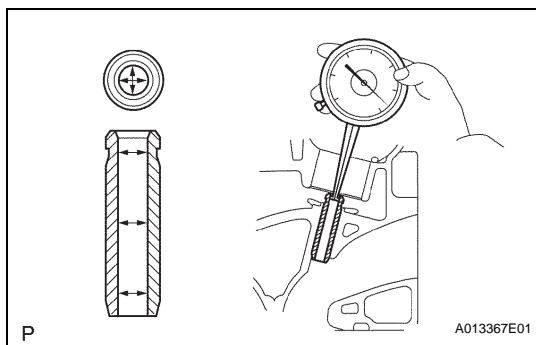
Standard oil clearance:

0.025 to 0.060 mm (0.0010 to 0.0024 in.)

Maximum oil clearance:

0.08 mm (0.0032 in.)

If the clearance is greater than the maximum, replace the valve and intake guide bush.



15. INSPECT EXHAUST VALVE GUIDE BUSH

- (a) Using a caliper gauge, measure the inside diameter of the guide bush.

Standard bush inside diameter:

5.510 to 5.530 mm (0.2169 to 0.2177 in.)

If the inside diameter is not as specified, replace the exhaust valve guide bush.

- (b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

Standard oil clearance:

0.030 to 0.065 mm (0.0012 to 0.0026 in.)

Maximum oil clearance:

0.10 mm (0.004 in.)

If the clearance is greater than the maximum, replace the valve and exhaust valve guide bush.

16. INSPECT CYLINDER HEAD SET BOLT

- (a) Using a vernier caliper, measure the length of the head bolts from the seat to the end.

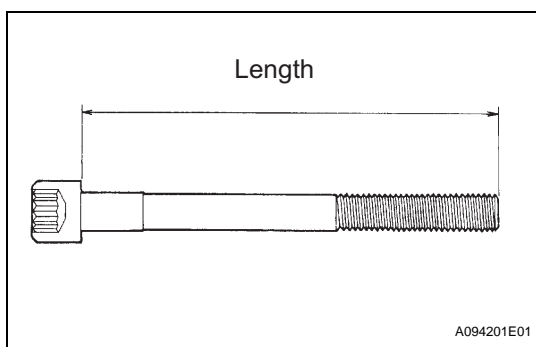
Standard bolt length:

141.3 to 142.7 mm (5.563 to 5.618 in.)

Maximum bolt length:

144.2 mm (5.677 in.)

If the bolt length is greater than the maximum, replace the cylinder head set bolt.



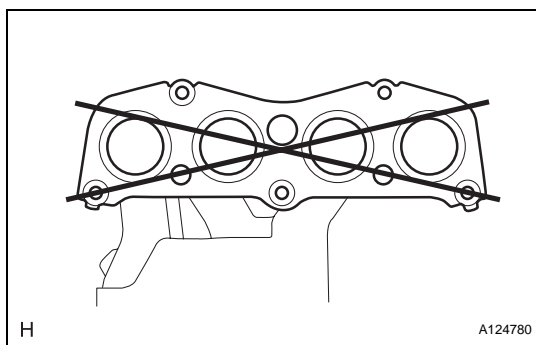
17. INSPECT EXHAUST MANIFOLD

- (a) Using a precision straightedge and a feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:

0.70 mm (0.028 in.)

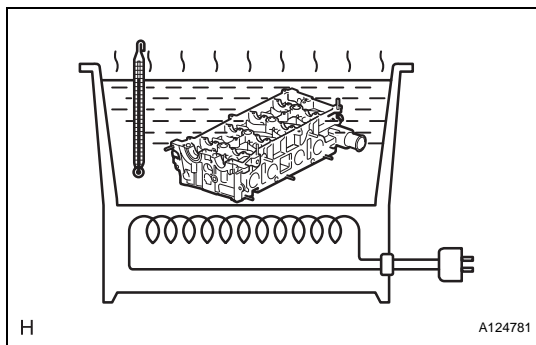
If the warpage is greater than the maximum, replace the exhaust manifold.

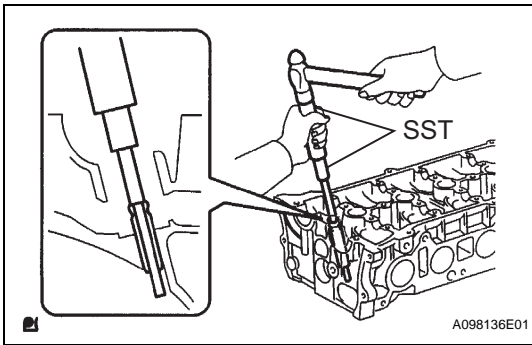


REPLACEMENT

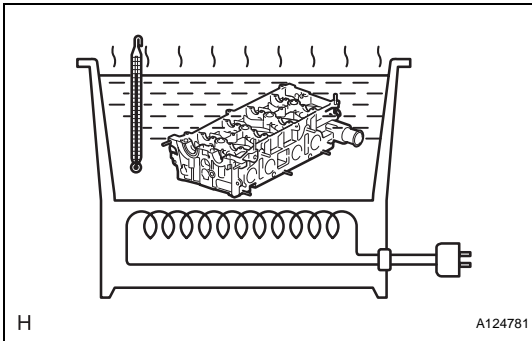
1. REPLACE INTAKE VALVE GUIDE BUSH

- (a) Heat the cylinder head to 80 to 100°C (176 to 212°F).
- (b) Place the cylinder head on wooden blocks.



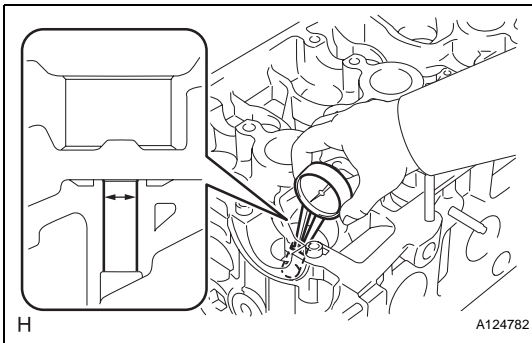


- (c) Using SST and a hammer, tap out the guide bush.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)



- (d) Heat the cylinder head to 80 to 100°C (176 to 212°F).

- (e) Place the cylinder head on wooden blocks.



- (f) Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Standard diameter:

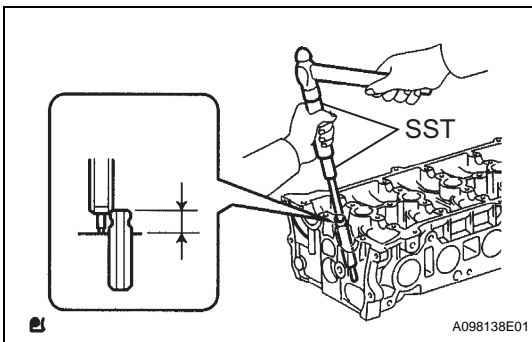
10.285 to 10.306 mm (0.4049 to 0.4058 in.)

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4058 in.), machine the bush bore to the dimension of 10.335 to 10.365 mm (0.4068 to 0.4077 in.).

Standard valve guide bush diameter

Condition	Specified Condition
STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S (0.05 mm)	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

If the bushing bore diameter of the cylinder head is greater than 10.394 mm (0.4092 in.), replace the cylinder head.

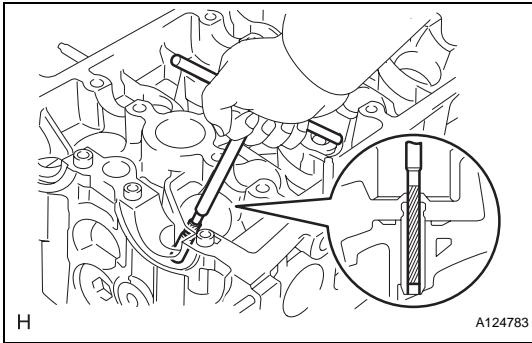


- (g) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

Standard protrusion height:

9.6 to 10.0 mm (0.378 to 0.394 in.)



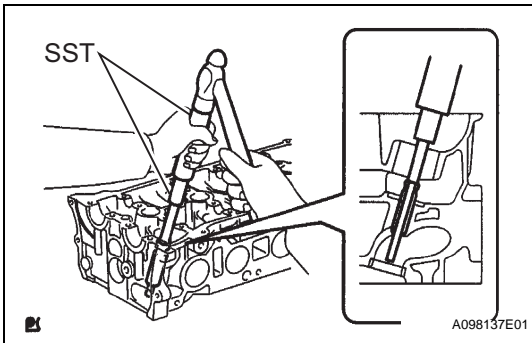
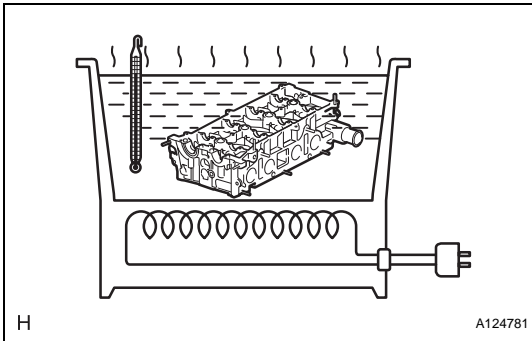
- (h) Using a sharp 5.5 mm reamer, ream the valve guide bush to the standard specified clearance between the valve guide bush and valve stem.

Standard oil clearance:

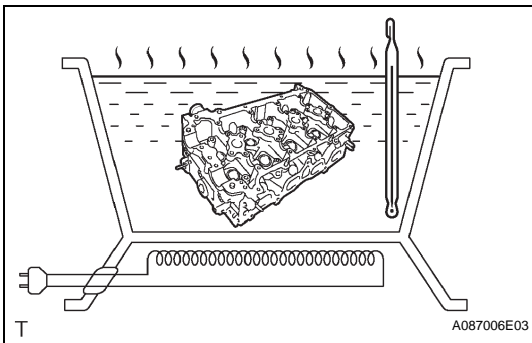
0.025 to 0.060 mm (0.0010 to 0.0024 in.)

2. REPLACE EXHAUST VALVE GUIDE BUSH

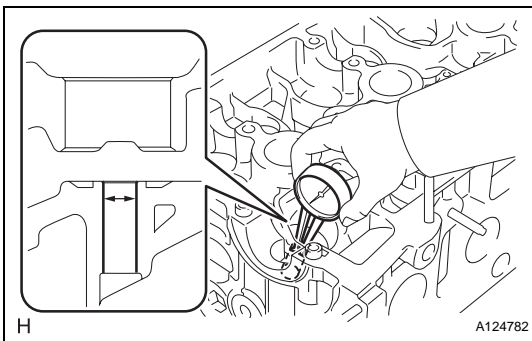
- (a) Heat the cylinder head to 80 to 100°C (176 to 212°F).
 (b) Place the cylinder head on wooden blocks.



- (c) Using SST and a hammer, tap out the guide bush.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)



- (d) Heat the cylinder head to 80 to 100°C (176 to 212°F).
 (e) Place the cylinder head on wooden blocks.



- (f) Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Standard diameter:

10.285 to 10.306 mm (0.4049 to 0.4058 in.)

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4058 in.), machine the bush bore to the dimension of 10.335 to 10.365 mm (0.4068 to 0.4077 in.).

Standard valve guide bush diameter

Condition	Specified Condition
STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S (0.05 mm)	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

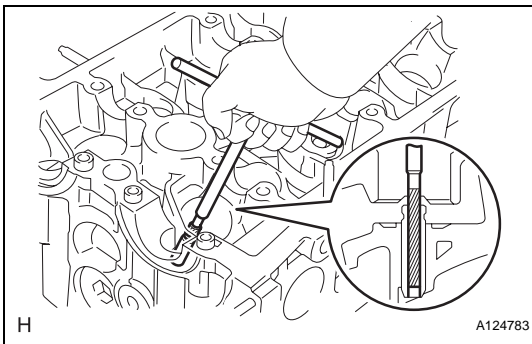
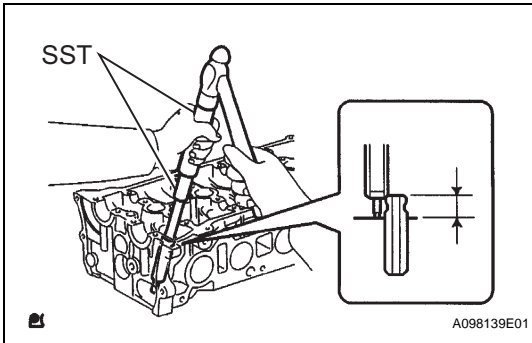
If the bushing bore diameter of the cylinder head is greater than 10.394 mm (0.4092 in.), replace the cylinder head.

- (g) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

Standard protrusion height:

9.6 to 10.0 mm (0.378 to 0.394 in.)



- (h) Using a sharp 5.5 mm reamer, ream the valve guide bush to the standard specified clearance between the valve guide bush and valve stem.

Standard oil clearance:

0.030 to 0.065 mm (0.0012 to 0.0026 in.)

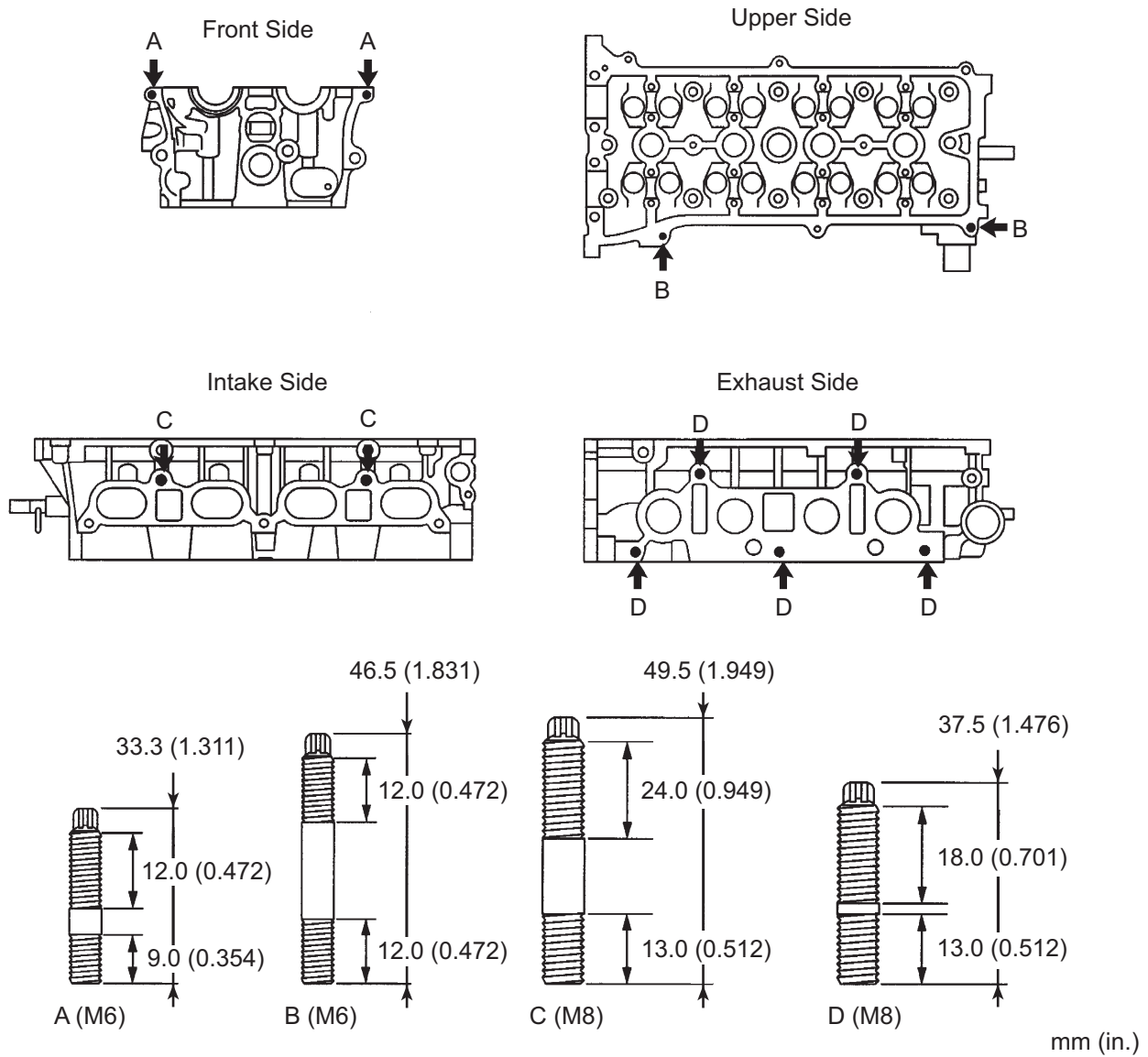
3. REPLACE STUD BOLT

NOTICE:

If the stud bolt is deformed or threads are damaged, replace it.

- (a) Using E5 and E7 "torx" socket wrenches, remove the 11 stud bolts.

- (b) Using E5 and E7 "torx" socket wrenches, install the 11 stud bolts.

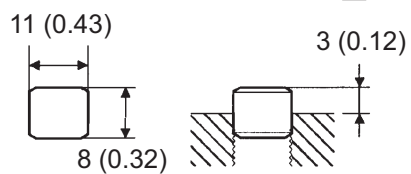
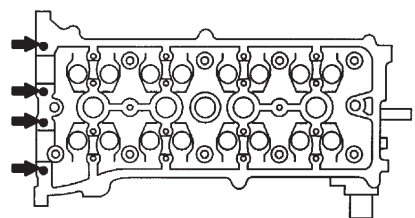


A098141E04

4. REPLACE RING PIN

- (a) Remove the 4 ring pins.

Upper Side



mm (in.)

A098140E04

- (b) Using a plastic-faced hammer, tap in 4 new ring pins to the specified protrusion height.

Protrusion height:
3.0 mm (0.12 in.)

REASSEMBLY

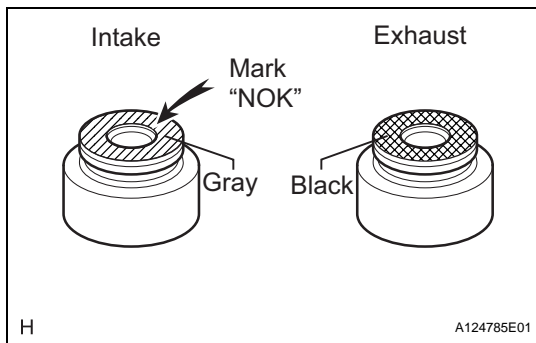
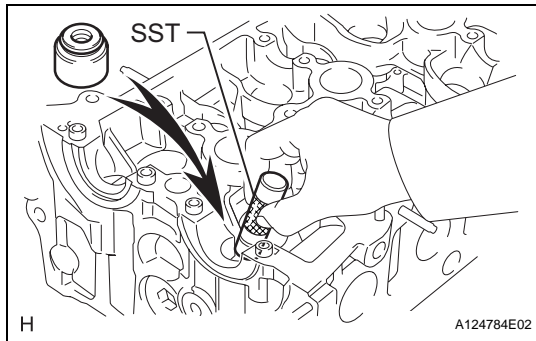
HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace oil seals with new ones.

1. INSTALL VALVE STEM OIL SEAL

- (a) Using SST, push in a new oil seal.

SST 09201-41020



HINT:

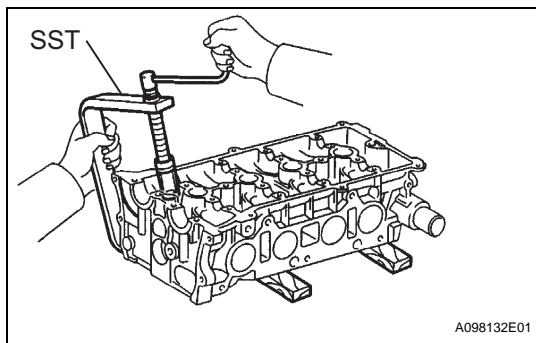
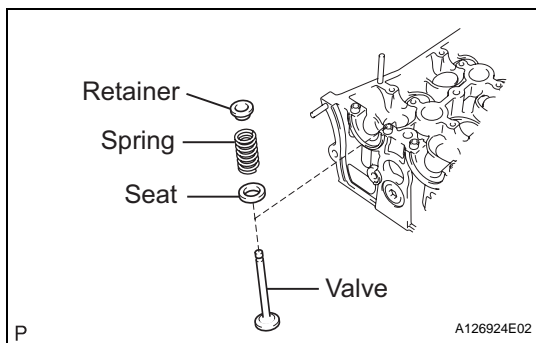
The intake valve oil seal is gray and the exhaust valve oil seal is black.

NOTICE:

Pay close attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal into the exhaust or installing the exhaust oil seal to the intake can cause installation problems later.

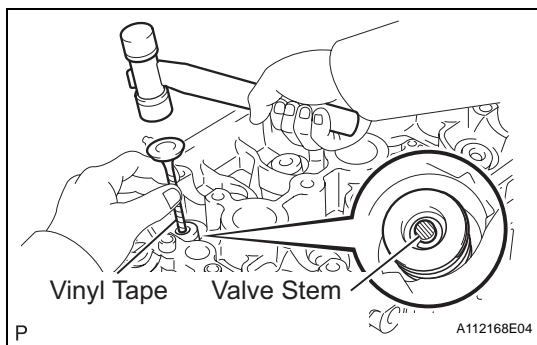
2. INSTALL INTAKE VALVE

- (a) Place the cylinder head on wooden blocks.
- (b) Install the valve, seat, spring and retainer onto the cylinder head.



- (c) Using SST, compress the spring, and place the 2 retainer locks around the valve stem.

SST 09202-70020 (09202-00010)



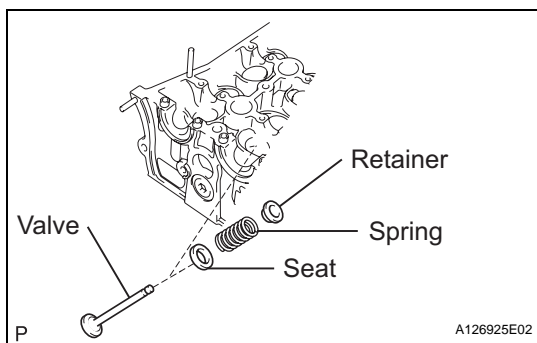
- (d) Using a plastic-faced hammer and discarded valve (with its tip wrapped with tape), lightly tap the installed valve to fit it into place.

NOTICE:

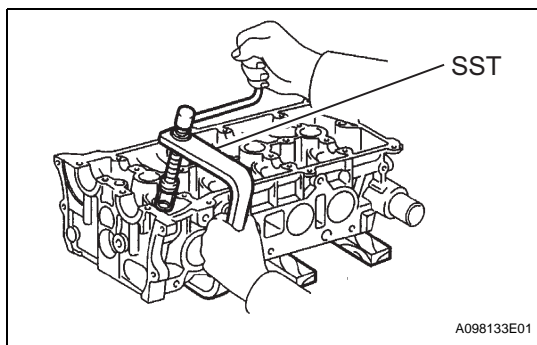
Be careful not to damage the valve stem tip.

3. INSTALL EXHAUST VALVE

- (a) Place the cylinder head on wooden blocks.

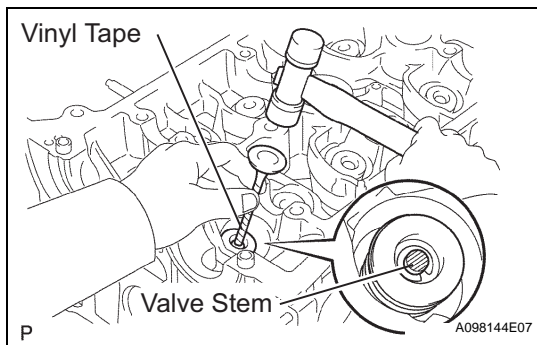


- (b) Install the valve, seat, spring and retainer onto the cylinder head.



- (c) Using SST, compress the spring, and place the 2 retainer locks around the valve stem.

SST 09202-70020 (09202-00010)



- (d) Using a plastic-faced hammer and discarded valve (with its tip wrapped with tape), lightly tap the installed valve to fit it into place.

NOTICE:

Be careful not to damage the valve stem tip.

4. INSTALL VALVE LIFTER

- (a) Assemble the valve lifter and the tip of the valve stem with a light coat of engine oil applied.

NOTICE:

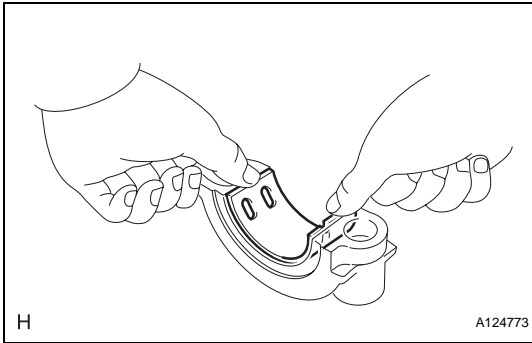
Install the valve lifters in their original places.

5. INSTALL NO. 1 CAMSHAFT BEARING

- (a) Clean the contact surface of the bearing and the bearing cap.

NOTICE:

Do not apply engine oil to the contact surfaces of the camshaft bearing and bearing cap.



- (b) Align the bearing claw with the claw groove of No. 1 and No. 2 bearing cap, and push in the No. 1 camshaft bearing.

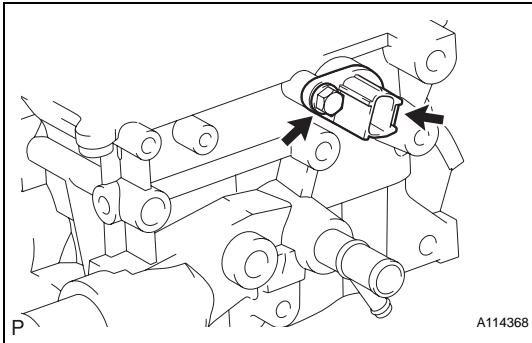
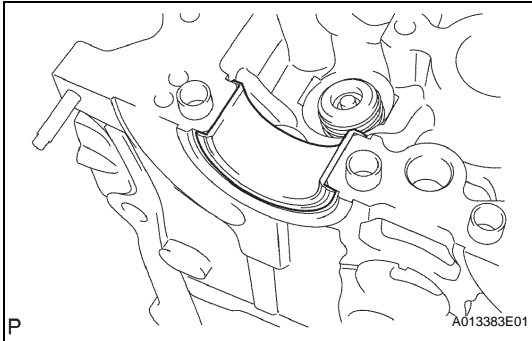
6. INSTALL NO. 2 CAMSHAFT BEARING

- (a) Clean the contact surface of the bearing and the bearing cap.

NOTICE:

Do not apply engine oil to the contact surfaces of the camshaft bearing and cylinder block.

- (b) Install the No. 2 camshaft bearing onto the cylinder head.



7. INSTALL CAMSHAFT POSITION SENSOR

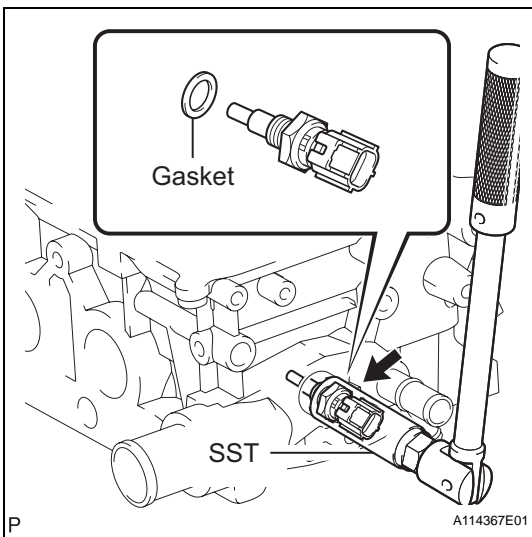
- (a) Install the camshaft position sensor with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

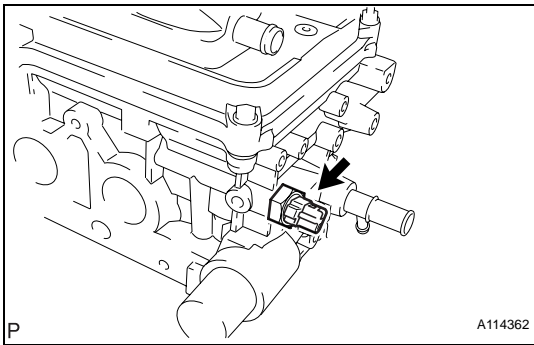
8. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

- (a) Using SST, install a new gasket and the ECT sensor.

SST 09817-33190

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)





9. INSTALL OIL PRESSURE SWITCH

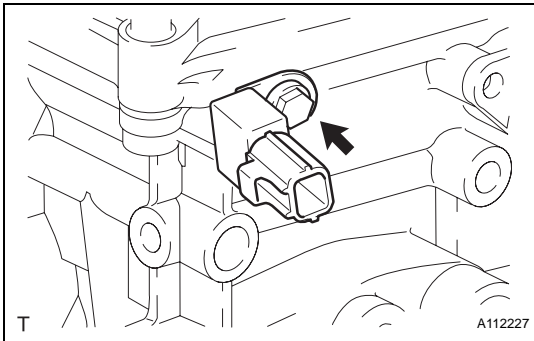
- (a) Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

- (b) Using a 24 mm deep socket wrench, install the oil pressure switch.

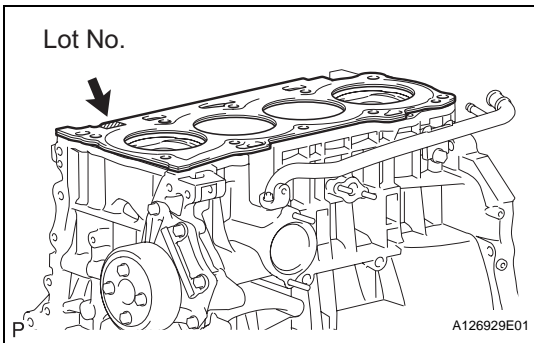
Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)



10. INSTALL RADIO SETTING CONDENSER

- (a) Install the condenser with the bolt.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)



INSTALLATION

1. INSTALL CYLINDER HEAD GASKET

- (a) Place a new gasket on the cylinder block surface with the Lot No. stamp facing upward.

NOTICE:

- Remove any oil from contact surface.
- Be careful of the installation direction.

2. INSTALL CYLINDER HEAD SUB-ASSEMBLY

- (a) Place the cylinder head on the head gasket.

NOTICE:

Place the cylinder head gently in order to avoid damaging the gasket.

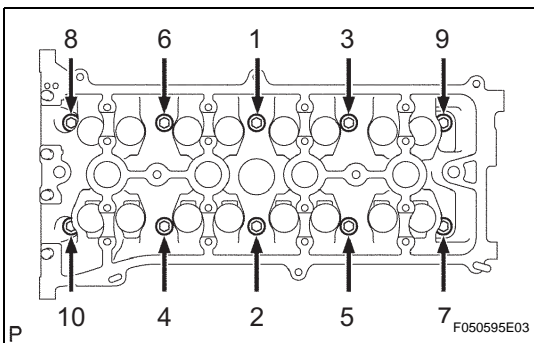
- (b) Install the cylinder head bolts.

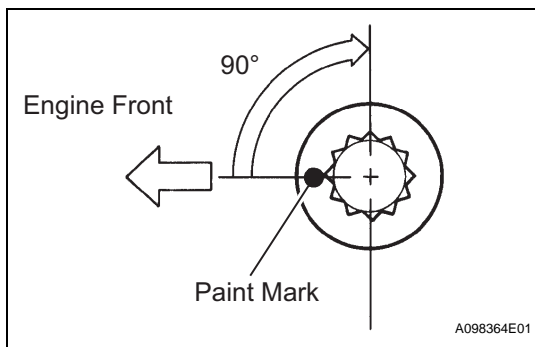
NOTICE:

The cylinder head bolts are tightened in 2 successive steps.

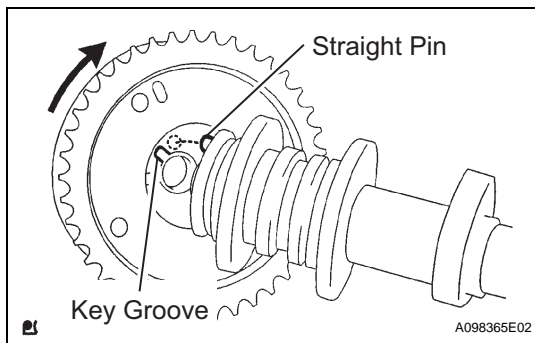
- (1) Apply a light coat of engine oil to the threads and under the heads of the cylinder head set bolts.
- (2) Using several steps, uniformly install and tighten the 10 cylinder head set bolts and plate washers with a 10 mm bi-hexagon wrench in the order shown in the illustration.

Torque: 70 N*m (714 kgf*cm, 52 ft.*lbf)





- (c) Mark the front of the cylinder head bolts with paint.
- (d) Retighten the cylinder head bolts by 90° as shown in the illustration.
- (e) Check that the paint mark is now at a 90° angle to the front.



3. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

- (a) Put the camshaft timing gear and camshaft together with the straight pin and key groove misaligned, as shown in the illustration.
- (b) Turn the camshaft timing gear as shown in the illustration while pushing it gently against the camshaft. Push further at the position where the pin fits into the groove.

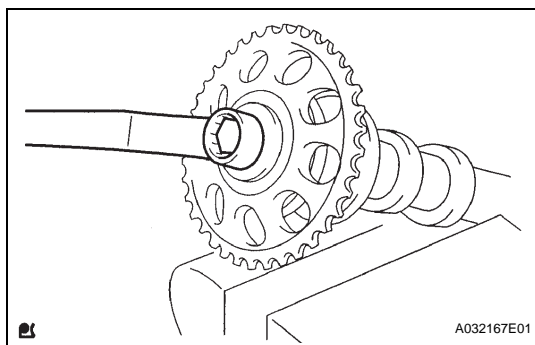
NOTICE:

Be sure not to turn the camshaft timing gear to the retard angle side (the right angle).

- (c) Check that there is no clearance between the gear fringe and camshaft.
- (d) Tighten the flange bolt with the camshaft timing gear fixed in place.

Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

- (e) Check that the camshaft timing gear can move to the retard angle side (the right direction) and is locked in the most retarded position.



4. INSTALL NO. 2 CAMSHAFT TIMING SPROCKET

- (a) Clamp the camshaft in a vise, then install the camshaft timing sprocket with the bolt.

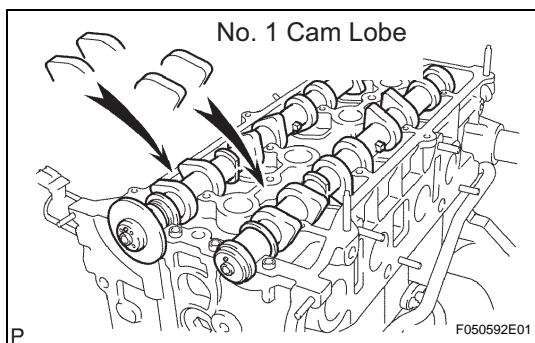
Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

NOTICE:

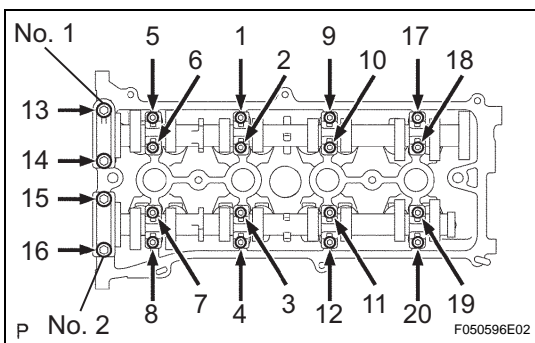
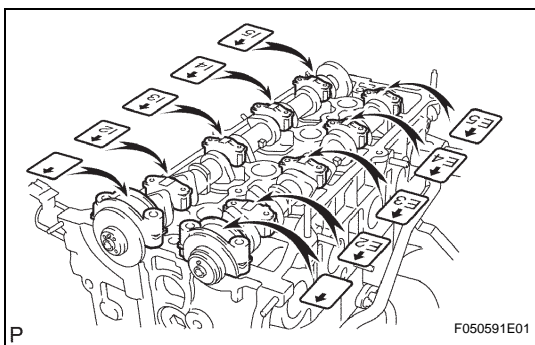
Do not damage the camshaft.

5. INSTALL CAMSHAFT

- (a) Apply a light coat of engine oil to the journal portion of the camshaft.



- (b) Place the 2 camshafts on the cylinder head with the No. 1 cam lobes facing the directions shown in the illustration.



- (c) Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps onto the cylinder head.
- (d) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

- (e) Using several steps, uniformly tighten the 20 bearing cap bolts in the sequence shown in the illustration.

Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf) for No. 1 and No. 2 bearing cap
 9.0 N*m (92 kgf*cm, 80 in.*lbf) for No. 3 bearing cap

NOTICE:

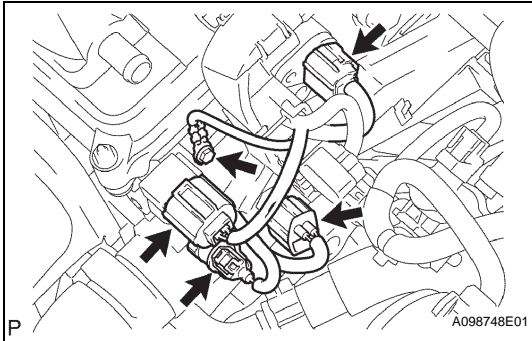
Install the camshaft with the timing mark of the camshaft timing gear on top.

6. INSTALL NO. 1 CHAIN VIBRATION DAMPER (See page [EM-33](#))
7. INSTALL CHAIN SUB-ASSEMBLY (See page [EM-33](#))
8. INSTALL CHAIN TENSIONER SLIPPER (See page [EM-34](#))
9. INSTALL TIMING CHAIN GUIDE (See page [EM-34](#))
10. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See page [EM-35](#))
11. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY (See page [EM-35](#))
12. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See page [EM-37](#))
13. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See page [EM-38](#))
14. INSTALL ENGINE MOUNTING BRACKET RH (See page [EM-38](#))
15. INSTALL CRANKSHAFT PULLEY (See page [EM-38](#))
16. INSTALL OIL PAN SUB-ASSEMBLY (See page [EM-39](#))
17. INSTALL CRANKSHAFT POSITION SENSOR (See page [ES-402](#))
18. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See page [EM-40](#))
19. INSTALL SPARK PLUG (See page [EM-16](#))
20. INSTALL IGNITION COIL ASSEMBLY (See page [IG-9](#))
21. INSTALL IDLER PULLEY (See page [EM-41](#))

22. INSTALL ENGINE MOUNTING INSULATOR RH (See page [EM-41](#))
23. INSTALL RADIATOR RESERVOIR (See page [EM-112](#))
24. INSTALL GENERATOR ASSEMBLY (See page [CH-15](#))
25. INSTALL FAN AND GENERATOR V BELT (See page [EM-7](#))
26. INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT RH (See page [EM-7](#))

27. CONNECT ENGINE WIRE

- (a) Connect the ground cable with the bolt.
Torque: 8.4 N*m (86 kgf*cm, 74 in.*lbf)
- (b) Connect the camshaft position sensor connector.
- (c) Connect the engine coolant temperature sensor connector.
- (d) Connect the engine oil pressure switch connector.
- (e) Connect the radio setting condenser connector.
- (f) Connect the heater water inlet hose.



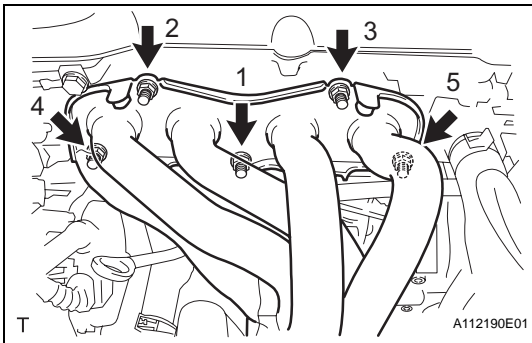
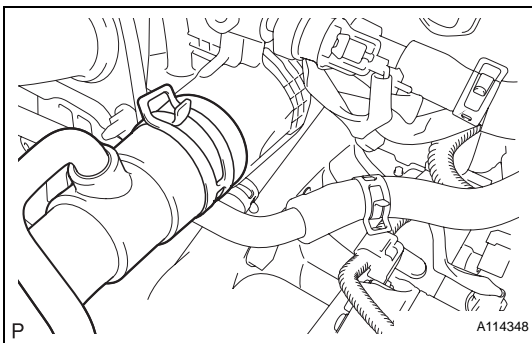
28. CONNECT NO. 1 RADIATOR HOSE

- (a) Connect the hose to the cylinder head.

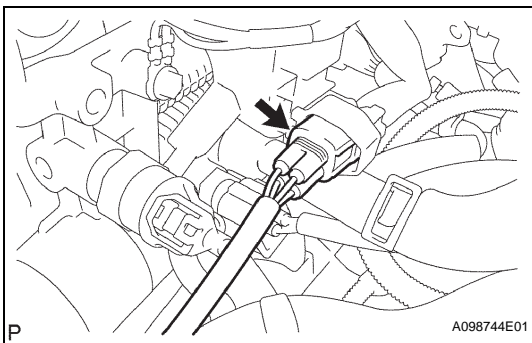
29. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page [ES-396](#))

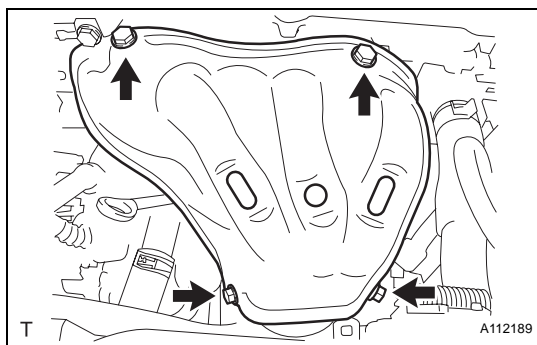
30. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

- (a) Install a new gasket onto the cylinder head.
- (b) Temporarily tighten the exhaust manifold converter with the 5 nuts.
Torque: 37 N*m (377 kgf*cm, 27 ft.*lbf)
- (c) Tighten the 5 nuts in the sequence shown in the illustration.



- (d) Connect the air-fuel ratio sensor connector.

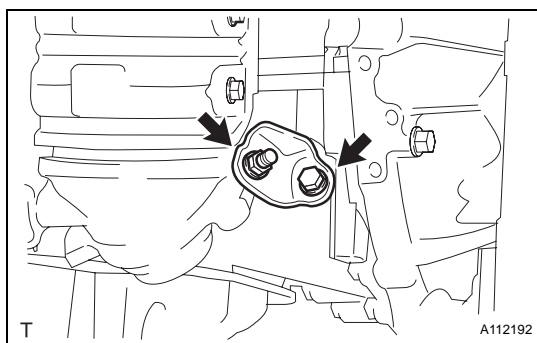




31. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR

- (a) Install the exhaust manifold heat insulator with the 4 bolts.

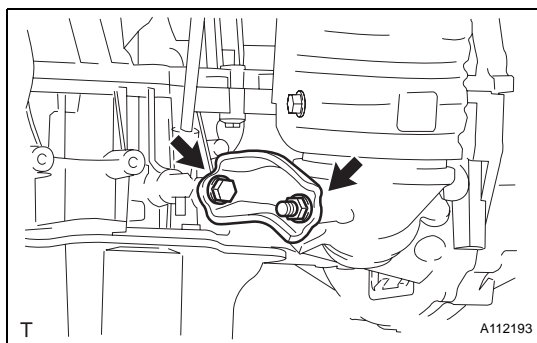
Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)



32. INSTALL NO. 2 MANIFOLD STAY

- (a) Install the stay with the bolt and nut.

Torque: 44 N*m (449 kgf*cm, 32 ft.*lbf)



33. INSTALL MANIFOLD STAY

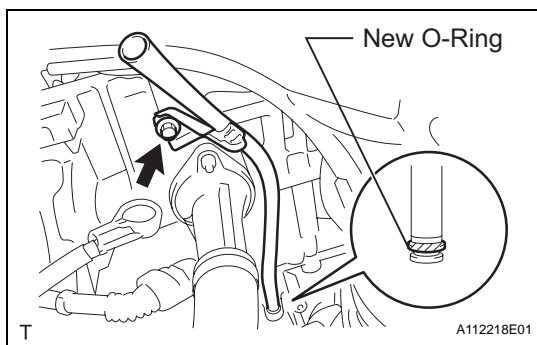
- (a) Install the stay with the bolt and nut.

Torque: 44 N*m (449 kgf*cm, 32 ft.*lbf)

34. INSTALL FRONT EXHAUST PIPE (See page [EX-4](#))

35. INSTALL OIL DIPSTICK GUIDE

- (a) Apply a light coat of engine oil to a new O-ring and install it onto the guide.



- (b) Install the guide with the bolt.

Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

36. INSTALL OIL DIPSTICK

37. INSTALL INTAKE MANIFOLD INSULATOR (See page [ES-421](#))

38. INSTALL INTAKE MANIFOLD (See page [ES-421](#))

39. INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY (See page [FU-13](#))

40. INSTALL THROTTLE BODY (See page [ES-413](#))

41. INSTALL AIR CLEANER CAP (See page [ES-413](#))

42. ADD ENGINE OIL (See page [LU-4](#))

43. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

44. CHECK FOR FUEL LEAKS

45. ADD ENGINE COOLANT (See page [CO-6](#))

46. CHECK FOR ENGINE COOLANT LEAKS

- (a) Check for engine coolant leaks (see page [CO-1](#)).

- 47. CHECK FOR ENGINE OIL LEAKS
- 48. CHECK FOR EXHAUST GAS LEAKS
- 49. INSPECT IGNITION TIMING (See page EM-1)
- 50. INSPECT ENGINE IDLING SPEED (See page EM-2)
- 51. INSPECT COMPRESSION (See page EM-3)
- 52. INSPECT CO/HC (See page EM-4)
- 53. INSTALL NO. 1 ENGINE COVER (See page EM-43)
- 54. INSTALL FRONT FENDER APRON RH
- 55. INSTALL NO. 1 ENGINE UNDER COVER
- 56. INSTALL FRONT WHEEL RH
- 57. INSTALL RADIATOR SUPPORT OPENING COVER

REPAIR

1. REPAIR VALVE SEATS

- (a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.
- (b) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.

Standard width

Item	Standard Condition
Intake	1.0 to 1.4 mm (0.0394 to 0.0551 in.)
Exhaust	1.2 to 1.6 mm (0.0427 to 0.0630 in.)

- (c) Lap the valve and valve seat by hand with an abrasive compound.
- (d) Recheck the valve seating position.

EM

